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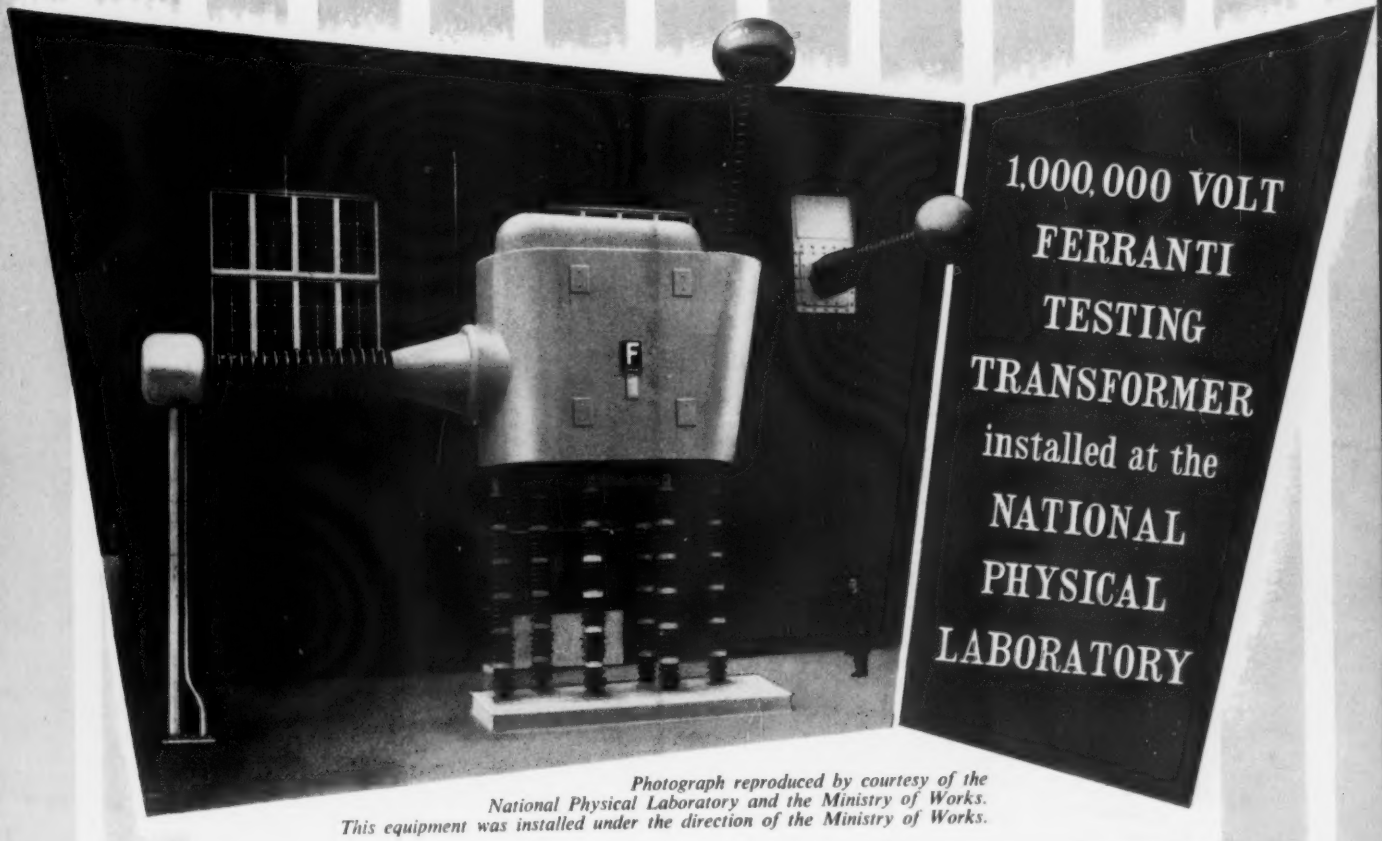

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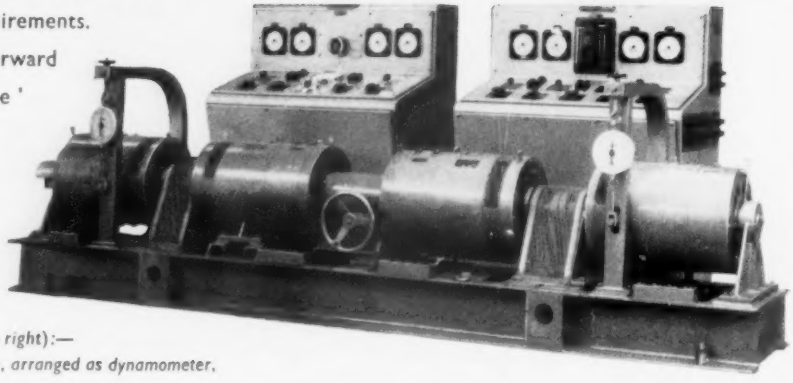

Recently supplied to the Welsh College of Advanced Technology, Cardiff—a multiple motor generator set, comprising 4 machines and two control desks. The machine unit comprises (left to right):—

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- *4 kVA alternator*
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- *The complete unit can be split into two motor-alternator sets*

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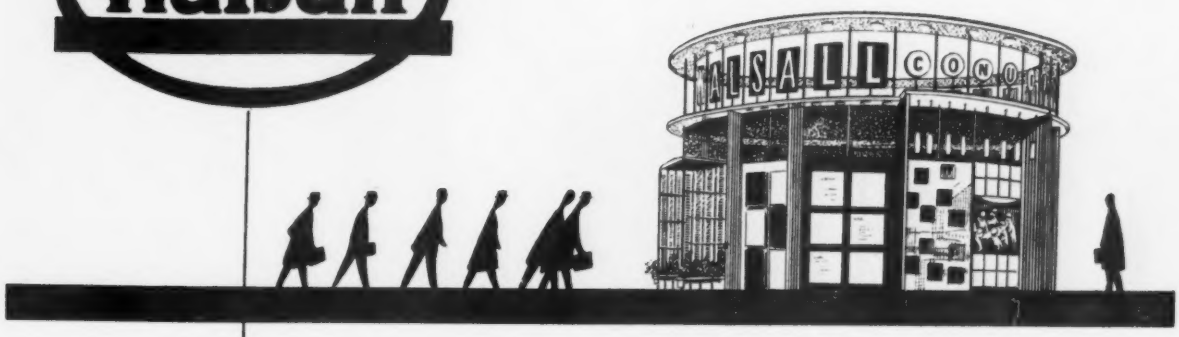
Walsall



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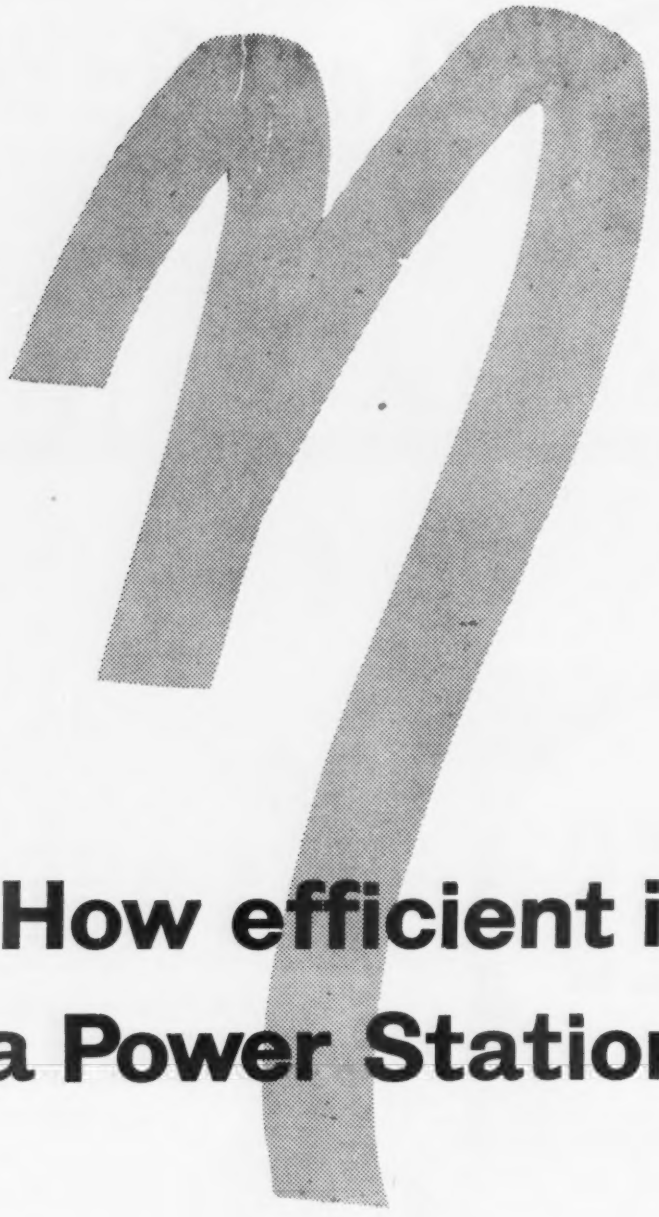

How efficient is a Power Station?

The term 'efficient' is often used loosely as an alternative to 'effective'. In Electricity Supply, however, the 'efficiency' of a power station has a well-defined and exact connotation. It indicates the heat energy expended to produce a unit of electricity.

Progressively, new power stations are more 'efficient' than their predecessors — they burn less coal for a given output. The engineers of the Central Electricity Generating Board are producing designs which, by increasing efficiency, enable power stations to offset substantially the rising costs of materials.

In spite of increased efficiency, however, the available supply of suitable coal cannot long keep pace with the demand for electricity, which doubles every decade. The gap that threatens in the not distant future will now be filled by the rapidly expanding nuclear power programme.

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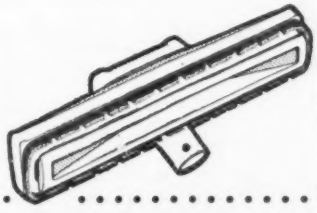
Cleaning nozzle or dusting brush at a touch. Here's the dusting brush. But turn it round, open the wings and there's the nozzle for cleaning upholstery, stair carpets, curtains; and the TELESCOPIC EXTENSION TUBE brings everything in the home within easy reach.



Carpet nozzle and floor brush in one. Here's the carpet nozzle—but press your toe lightly on it and—presto—it's the brush for hard floors. And it's just as simple to turn it into the carpet nozzle again. Electrolux cleans *all* the floors quickly and effortlessly with only one tool.

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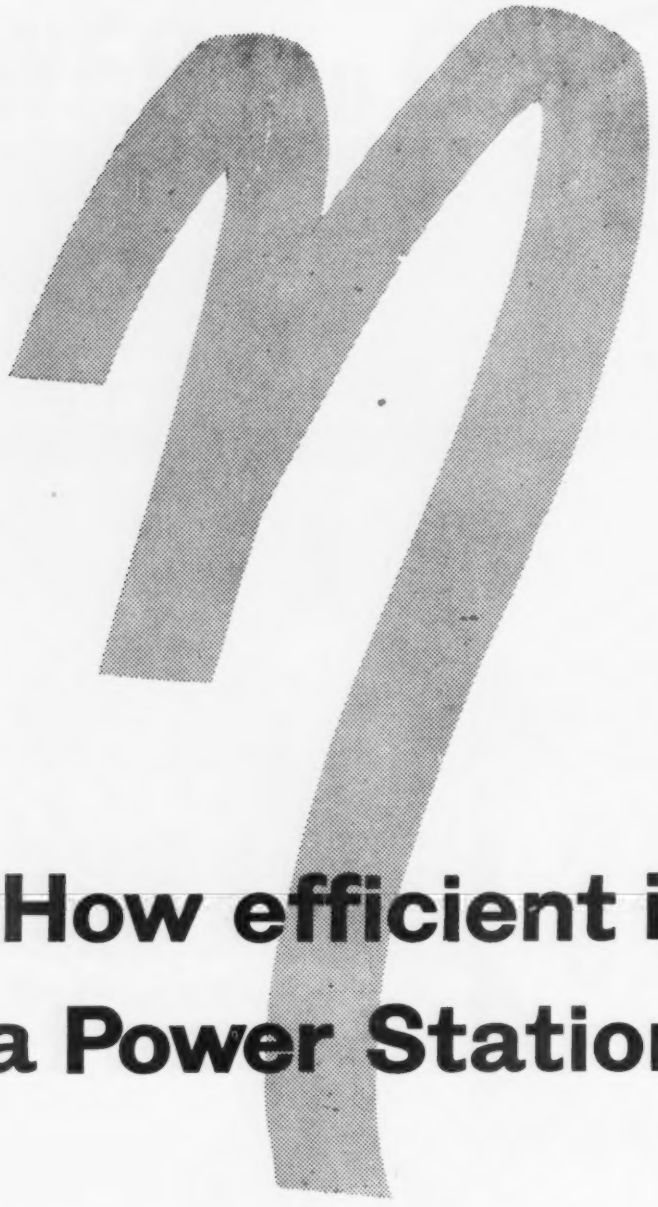

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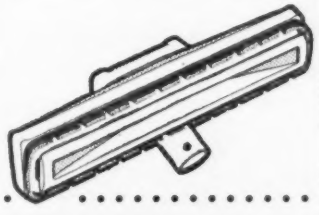

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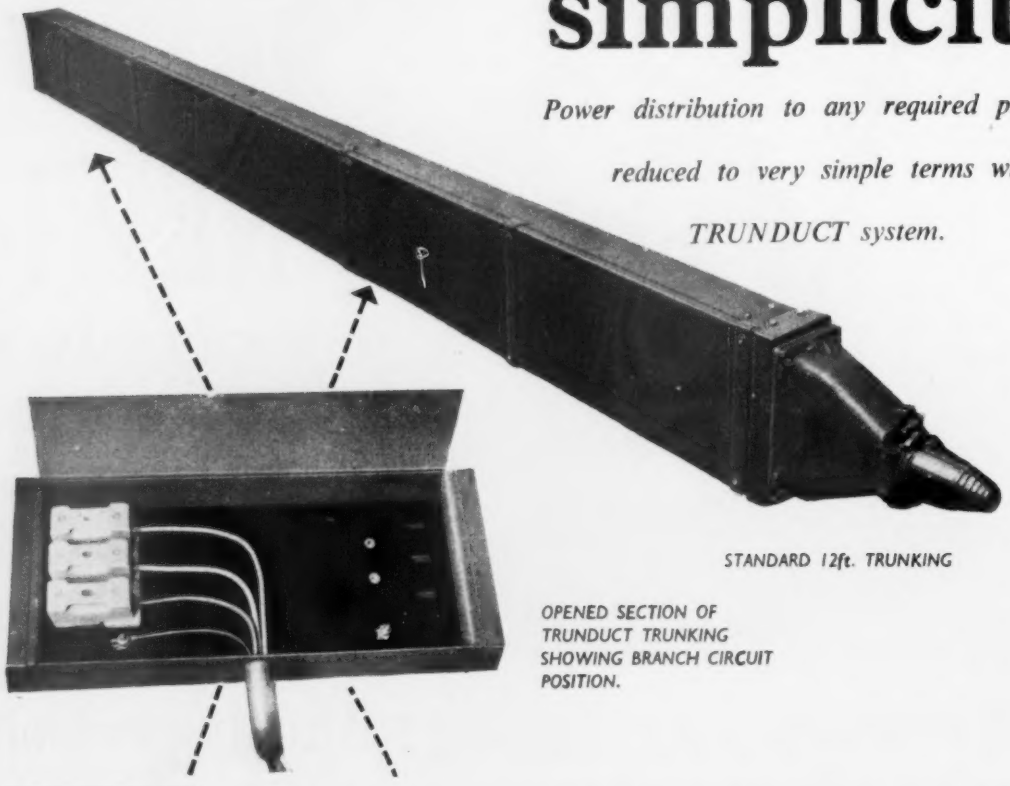

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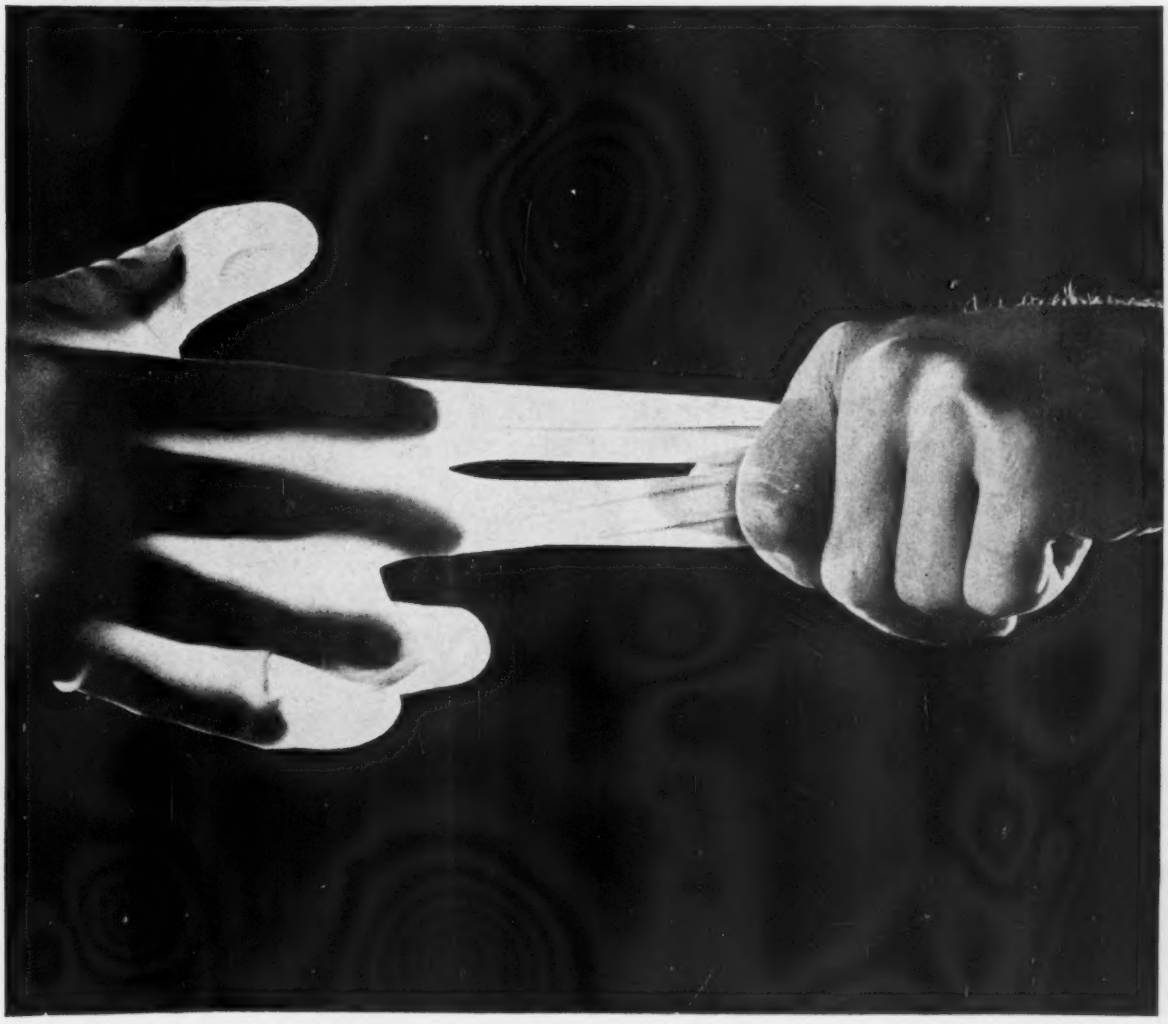

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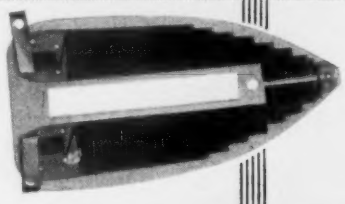

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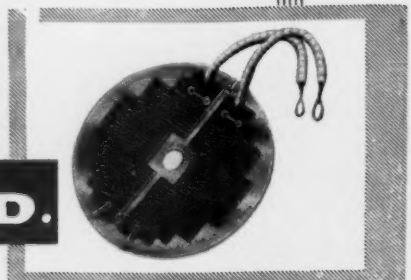

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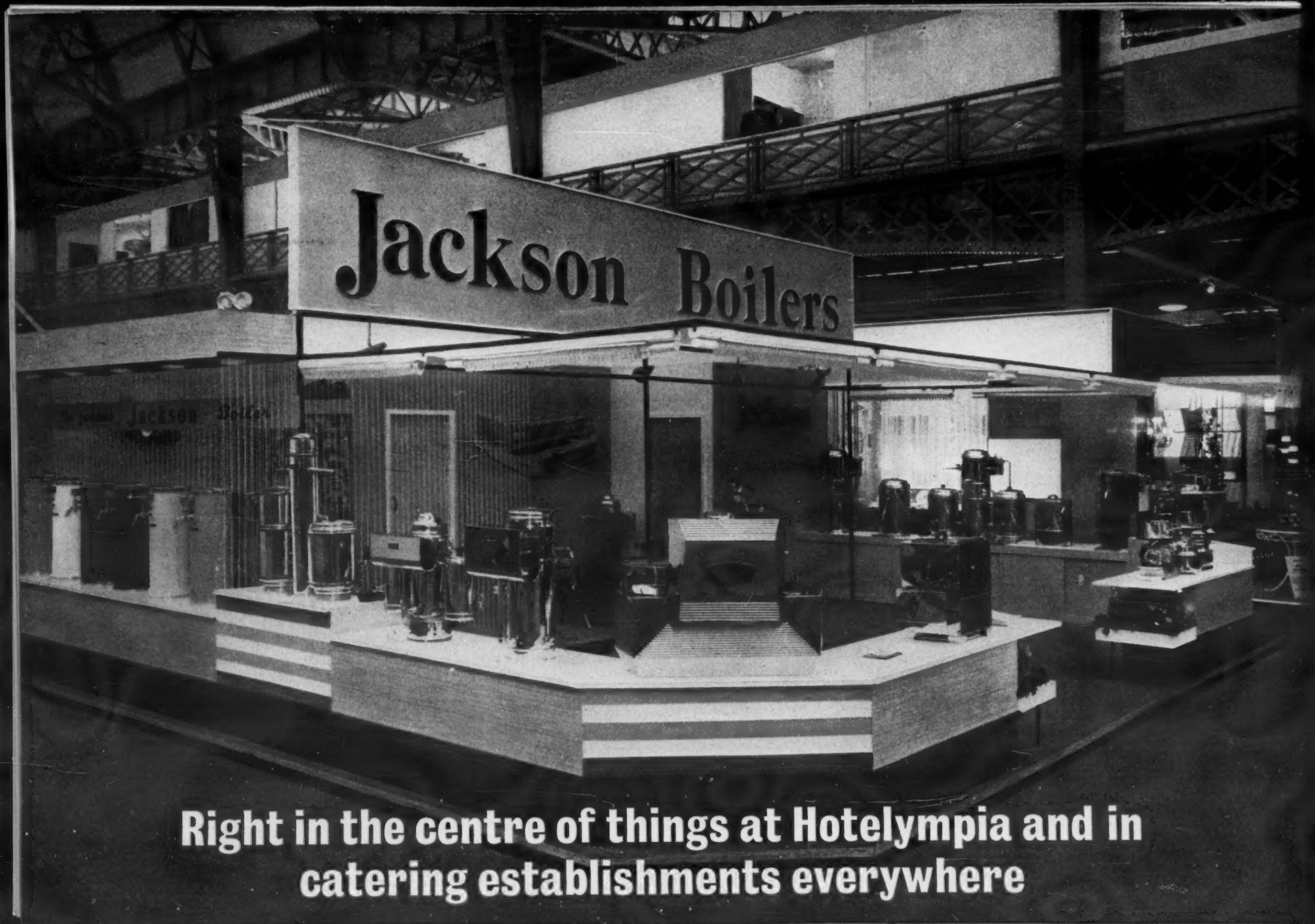

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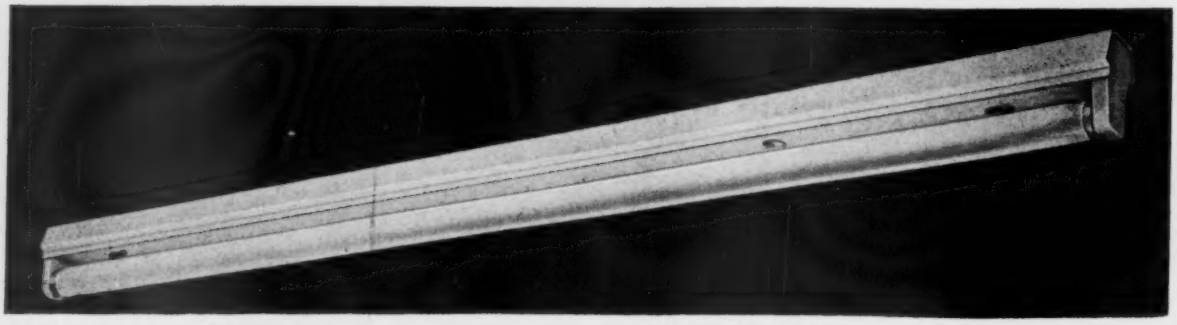

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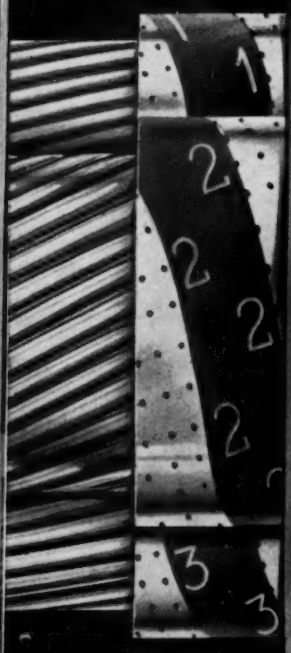

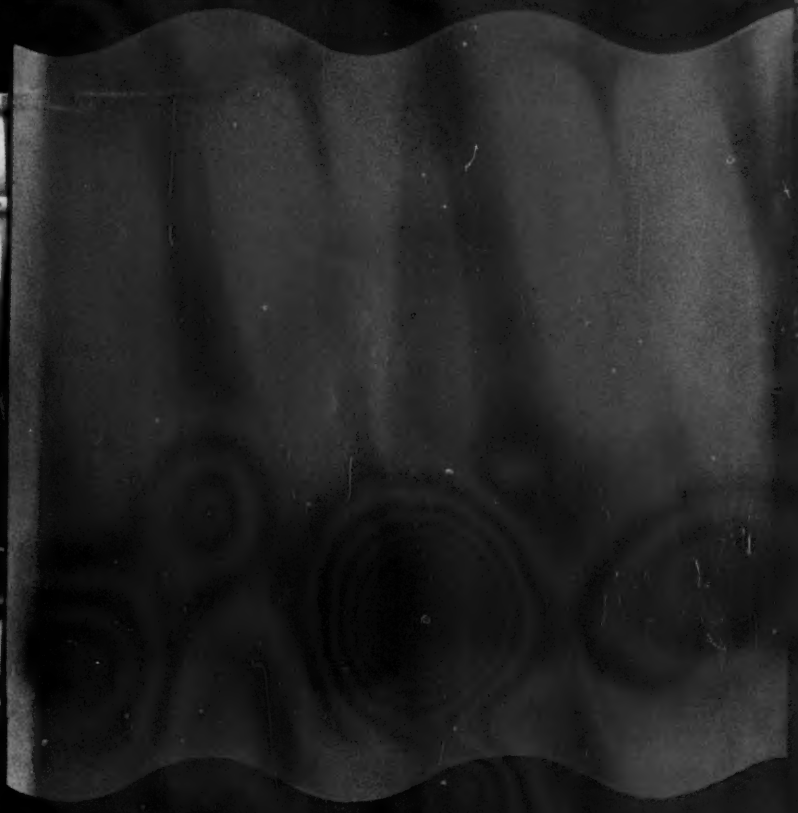

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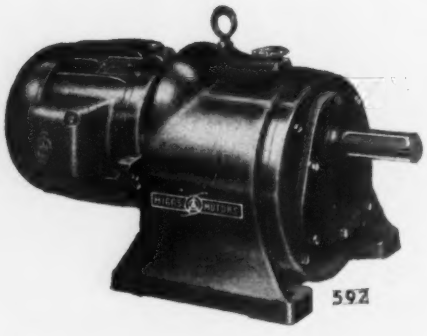

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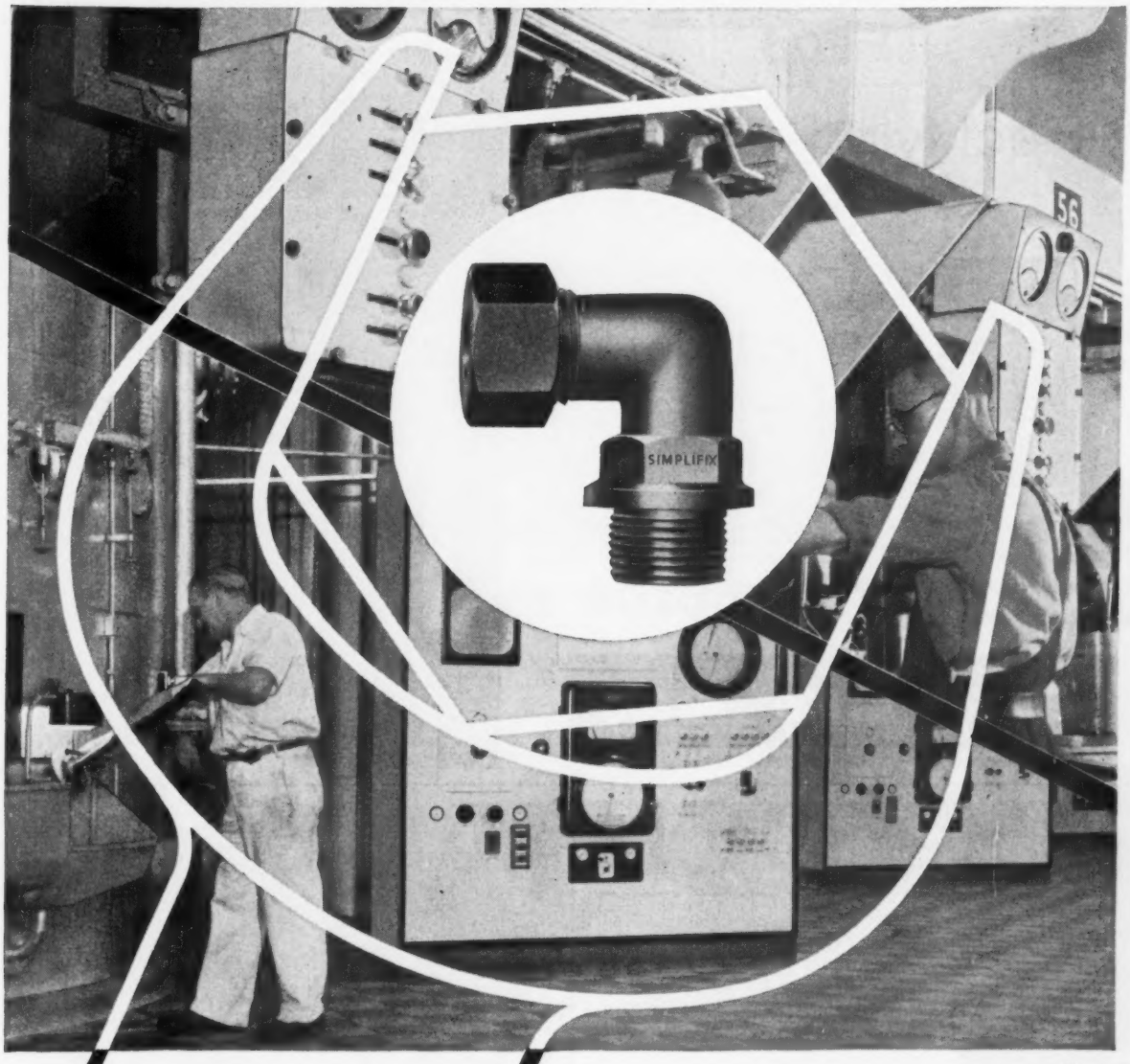

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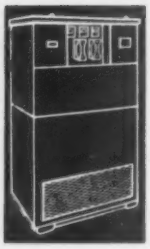

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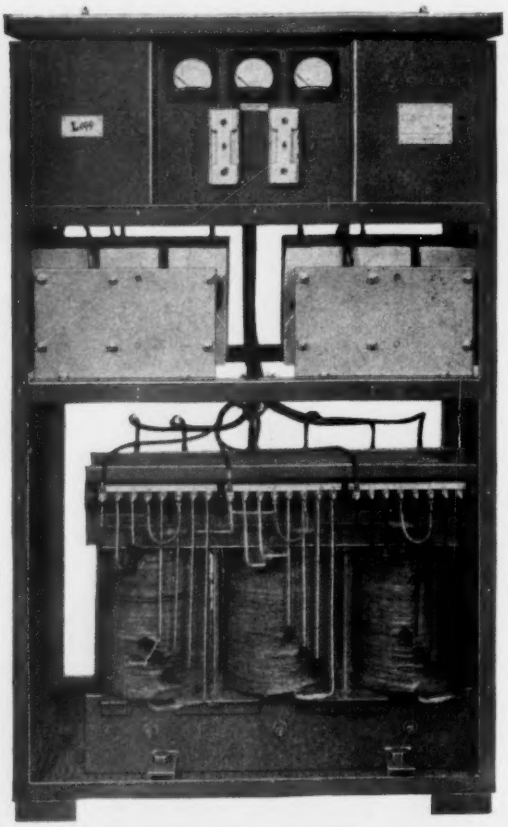

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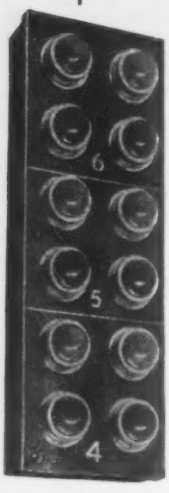

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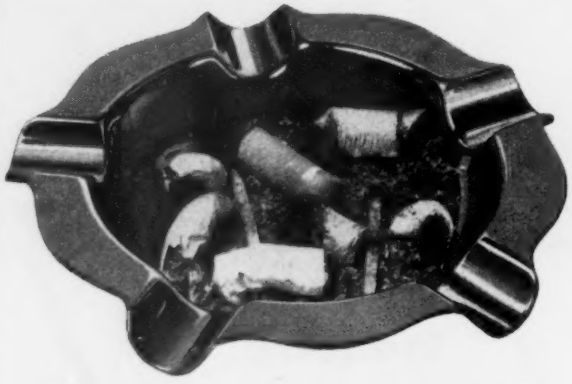

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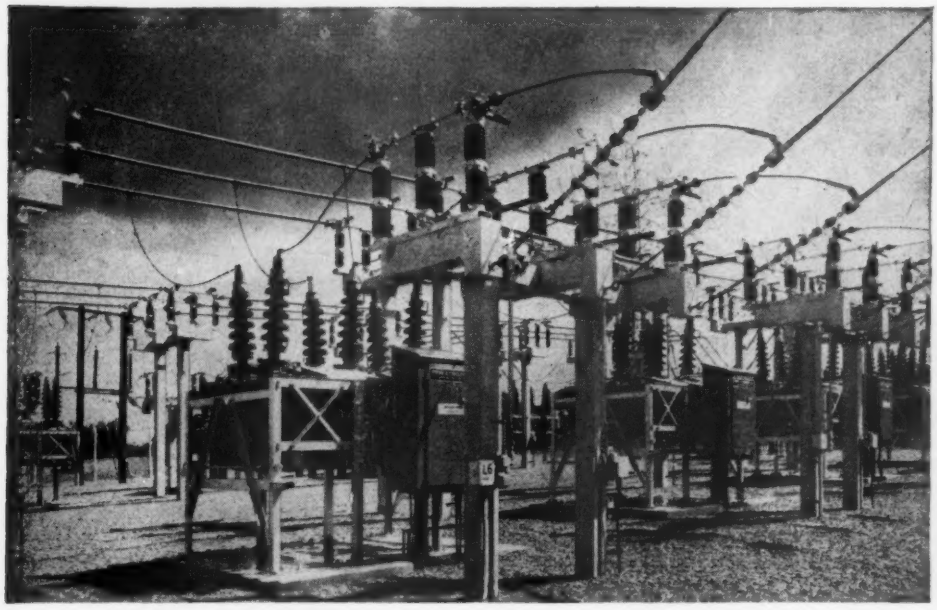

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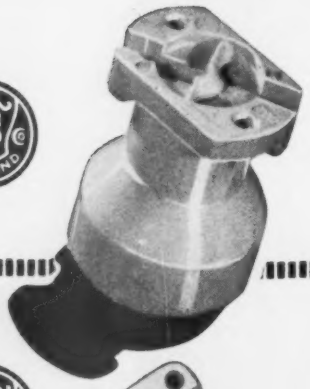

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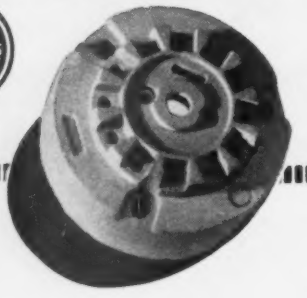

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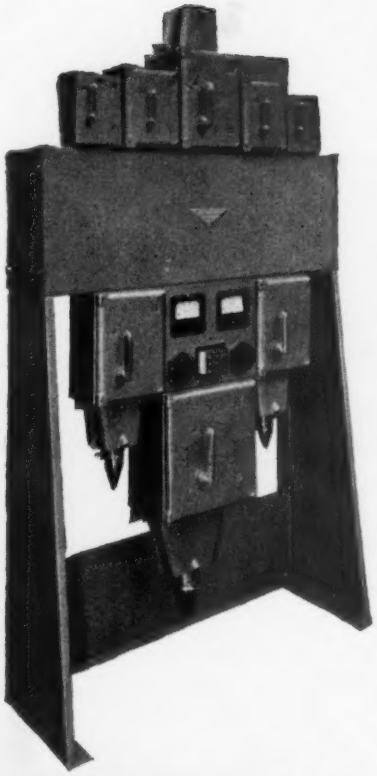

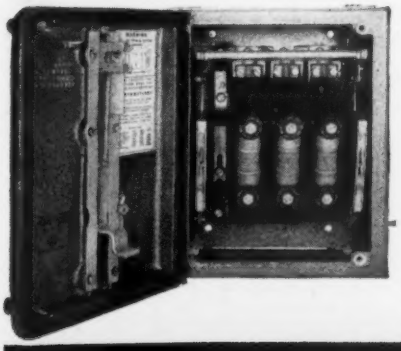

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★ *When space is limited and a large switchboard would be an even larger problem . . .*

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To: Dorman & Smith Ltd.,
Atherton Works, Blackpool Rd., Preston, Lancs.

Please send latest Dorman Switchgear and Switchboard Catalogue.

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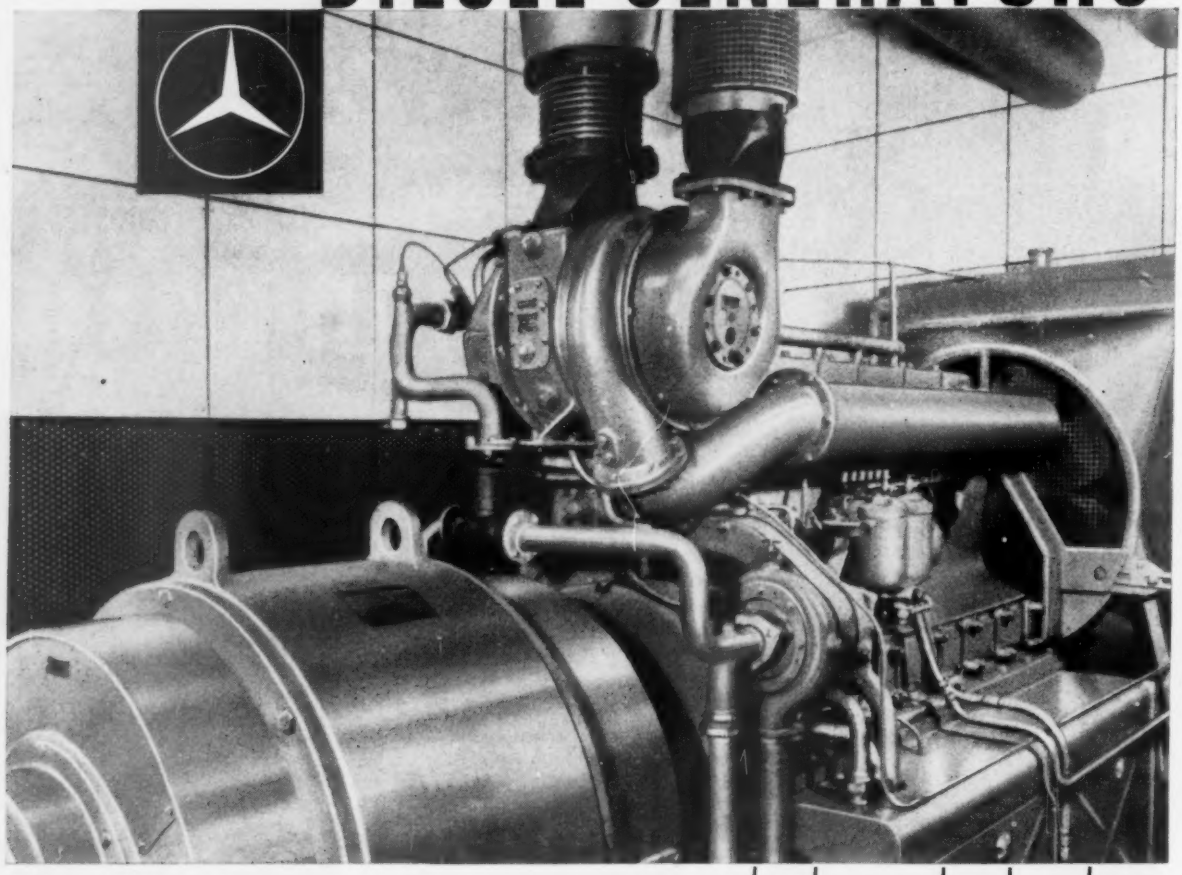
MERCEDES-BENZ

DIESEL GENERATORS



The Mercedes-Benz Diesel Generator is today's most efficient, easily maintained and economical source of electrical power in its field. The very name guarantees its dependability. Ranging from 2 to 12 cylinders, these generating sets are light and compact, keeping vibration to a minimum. Ideal for locations where the foundation is not excessively strong.

Mercedes-Benz have been producing generating sets for many years, adhering to the same principles of high quality workmanship which have made the name Mercedes-Benz famous throughout the world.

K.V.A.	Motor Type	No. of Cylinders	Speed r.p.m.	Weight kg.
26 34	M 202 B	2	750 1000	1900
42 57	M 203 B	3	750 1000	2300
57 76	M 204 B	4	750 1000	2500
12.5 24	OM 636	4	1500 3000	650
36 43	OM 312 OM 321	6 6	1500 1500	1000 1200
78 96	OM 315 OM 326	6 6	1500 1500	1800 2000
127 182	MB 846 A	6	1000 1500	4000
167 235	MB 846 Ab	6	1000 1500	4200
190 260	MB 836 B	6	1000 1500	5300
250 360	MB 836 Bb	6	1000 1500	5500
305 470	MB 836 Db	6	1000 1500	5800
380 525	MB 820 B	12	1000 1500	8000
520 735	MB 820 Bb	12	1000 1500	9000
655 990	MB 820 Db	12	1000 1500	10000

Write for full particulars to:

MERCEDES-BENZ (GREAT BRITAIN) LTD, INDUSTRIAL DIESEL ENGINE DIVISION

RALEIGH HOUSE, GREAT WEST ROAD, BRENTFORD, MIDDLESEX Tel: ISLEWORTH 5341

NEWS SHEET

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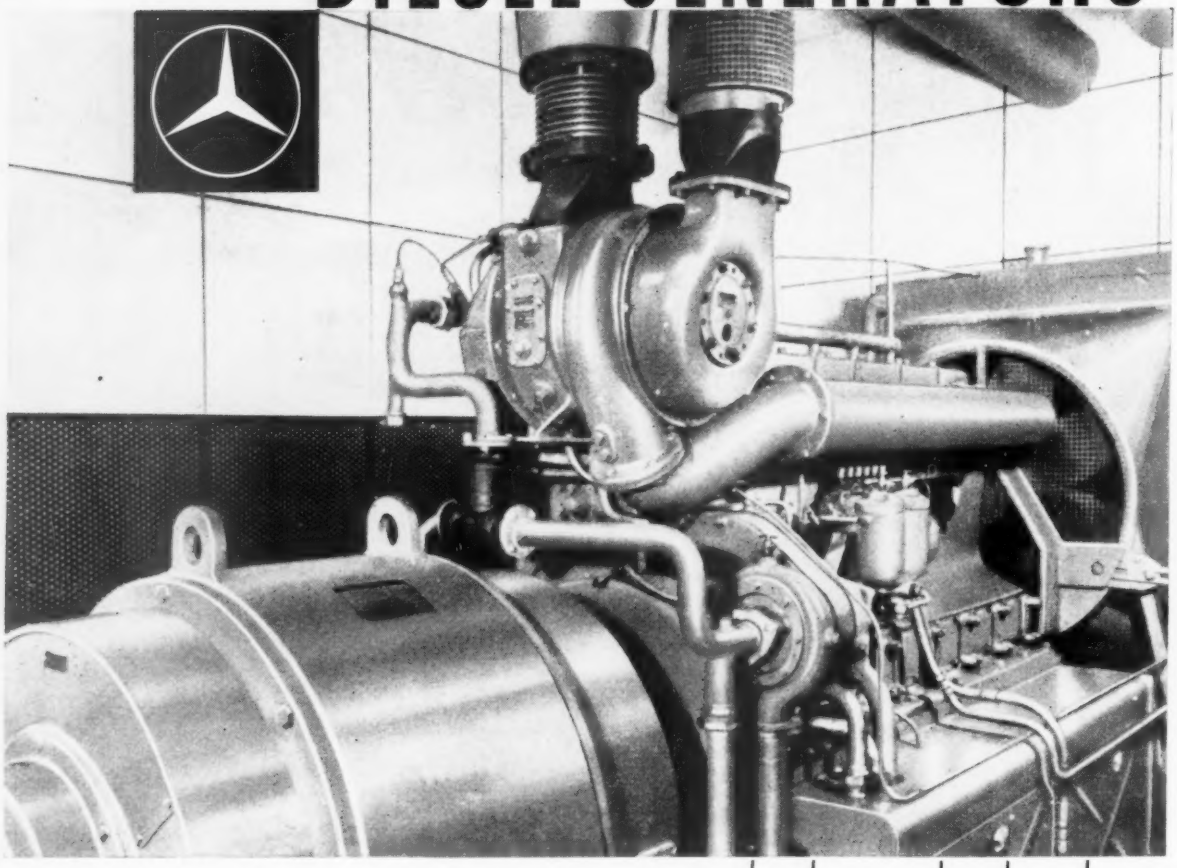
MERCEDES-BENZ

DIESEL GENERATORS



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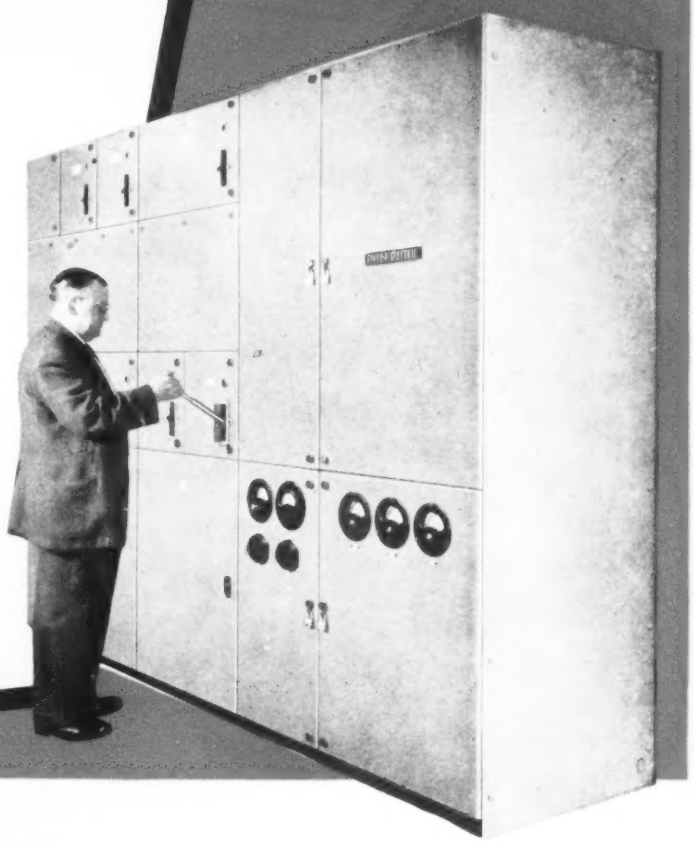
JOINT SWITCHBOARD INSTALLATIONS

REDUCE COSTS IN INDUSTRIAL SUBSTATIONS

The illustration shows a composite 'Superform' switchboard installed in the substation of a large warehouse in the Midlands. The switchboard accommodates both the Supply Authority's open type substation equipment and the outgoing circuits to the warehouse within the one unit. The busbars of the substation board and outgoing 'Superform' section are coupled together, both electrically and mechanically, making the composite Switchboard a complete entity.



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'ENGLISH ELECTRIC'

'Superform' Switchboards

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2.

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FG.46

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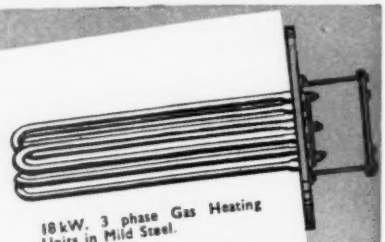
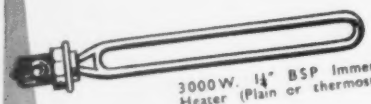


18 kW. 3 phase Gas Heating Units in Mild Steel.



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Let us design and quickly make for you **TUBULAR SHEATHED HEATING ELEMENTS** *in*

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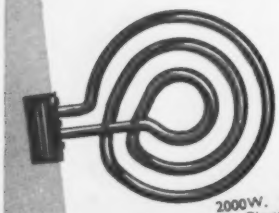

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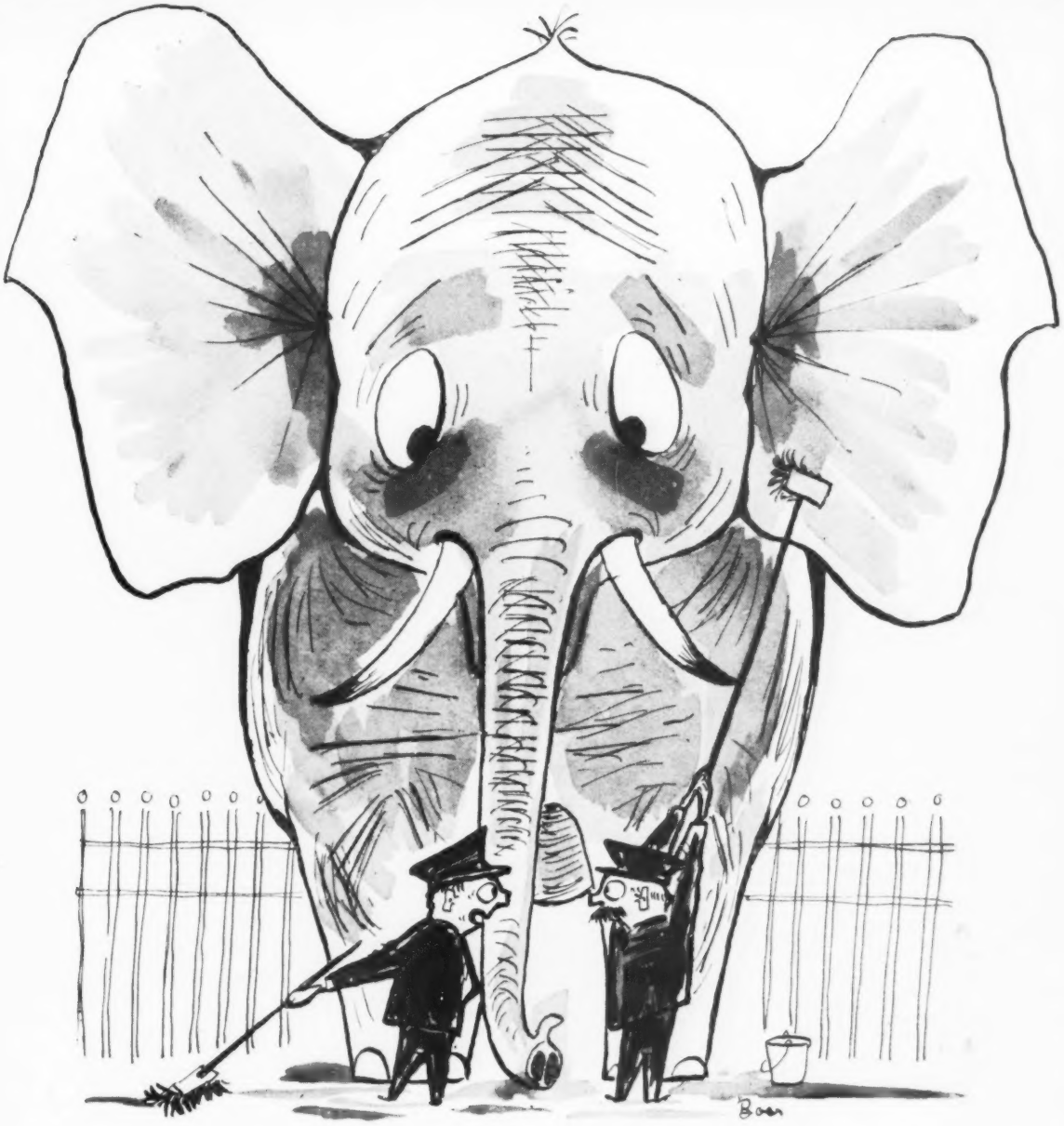
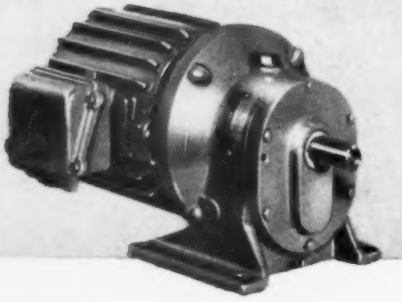
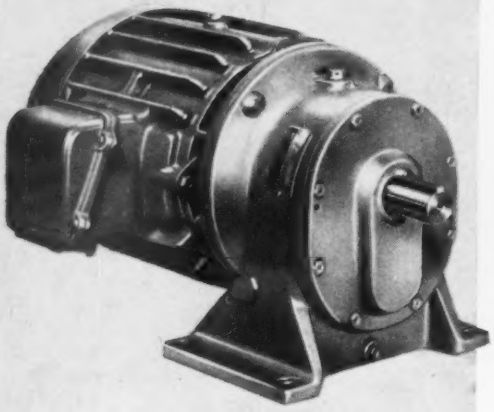


For your ears alone I tell's him straight. Elephants is mass production jobs, I says. No finish to 'em! That don't suit him right at all so he offs to that Symonds outfit. Now a trunk call to him means copper wire—miles of it, and every inch tested proper. Precision stuff, that's what he deals with. As for this 'ere elephant—its just an 'orrible mistake.

Serious enquiries please to R. H. SYMONDS LTD. *47 Victoria St., S.W.1. Tel: Abbey 2771/5*

Low-cost
geared motor units for industrial service





Type RSD geared motor units have been developed for the many industrial applications where normal standards of silence and efficiency are entirely adequate, and where the use of ultra high-precision gears is not justified.

Three sizes of standard gearbox are offered in a wide range of standard ratios at ratings varying from 1 h.p. at 92 r.p.m. to 7.5 h.p. at 290 r.p.m. All units are equipped with British Standard Dimension motors in either enclosed or ventilated form.

For more arduous duties, and where the highest degree of precision and efficiency is required, AEI recommend the well-established Type RGD units, available up to 40 h.p. output and at ratios up to 23.21:1

AEI

Associated Electrical Industries Limited
Motor and Control Gear Division
RUGBY AND MANCHESTER , ENGLAND

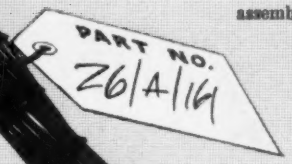
INCORPORATING THE MOTOR AND CONTROL GEAR INTERESTS OF BTH AND M-V

A1400

Whole in one

It's a comforting thought that a complete wiring system, embracing perhaps five hundred connections, can be bought-in simply by quoting one part number.

Preformed wiring by Plessey, in conjunction with Plessey plugs and sockets, solves many of the problems encountered in the making up of wiring assemblies used in the manufacture of electronic and electrical equipment, and the benefits both structurally and economically are considerable.



One order on Plessey for a complete assembly — or set of assemblies — means only one supplier to progress — only one item to be dealt with by the various departments concerned.

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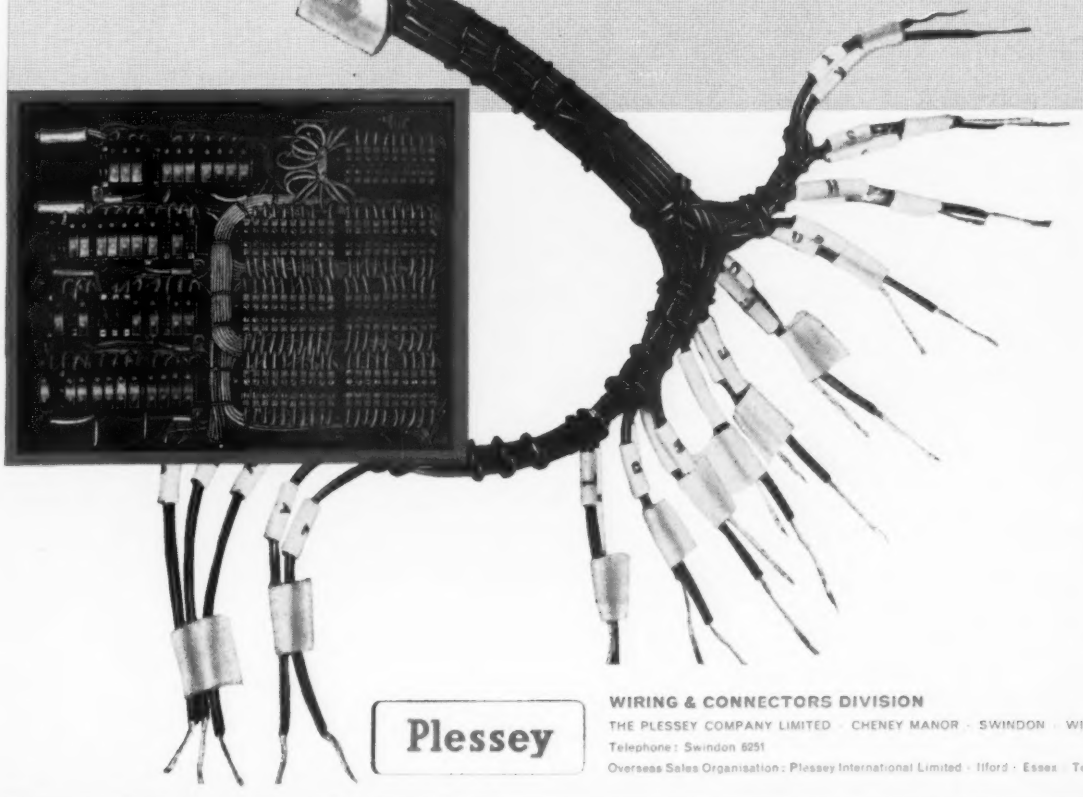
In providing complete wiring forms, cable assemblies and junction boxes to special requirements, the maximum economy can be achieved by calling in Plessey at the design stage. In this way can the wide experience of the engineers be used to your full advantage.



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Overseas Sales Organisation: Plessey International Limited · Ilford · Essex · Tel: Ilford 3040

CW 11

"Ever thought of coal-crushing as a career?"

they asked us.

"Er . . . no" we confessed—not realising that anyone crushed coal on purpose.
"A job of National Importance" they tempted us.
"O.K., we'll take it," we agreed.
"Don't run away with fancy ideas," they warned, "your job will be insulating the electric motors that operate the plant."
"A pushover," we replied recklessly.
"If you don't mind working entirely without ventilation" they said "totally enclosed by welded-in sheet steel covers. Gets kind of hot"—they added nastily.
"Just our cup of tea," we gulped—and took the job.
Years later—meaning now—we are still at it.
Is it hot? Compared to this situation, the equator is a cold bath. Do we break down? Never!
Fibreglass electrical insulation can take anything!

If it's tough, it's just the job for
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Here is the Squirrel Cage Motor with staying power, built for a lifetime of service. It is immediately available from stock in outputs up to 25h.p. Standard dimensions to B.S.2083 (1956). Full details are given in Technical Description No. 431.

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Elegant appearance and available in 1, 2, 3 and 4 Gang; Brown or Cream.

Shallow projection allows $\frac{1}{8}$" minimum wiring space in an ordinary plaster-depth box.

Recessed fixing screws which cannot be touched with the B.S. Test Finger.

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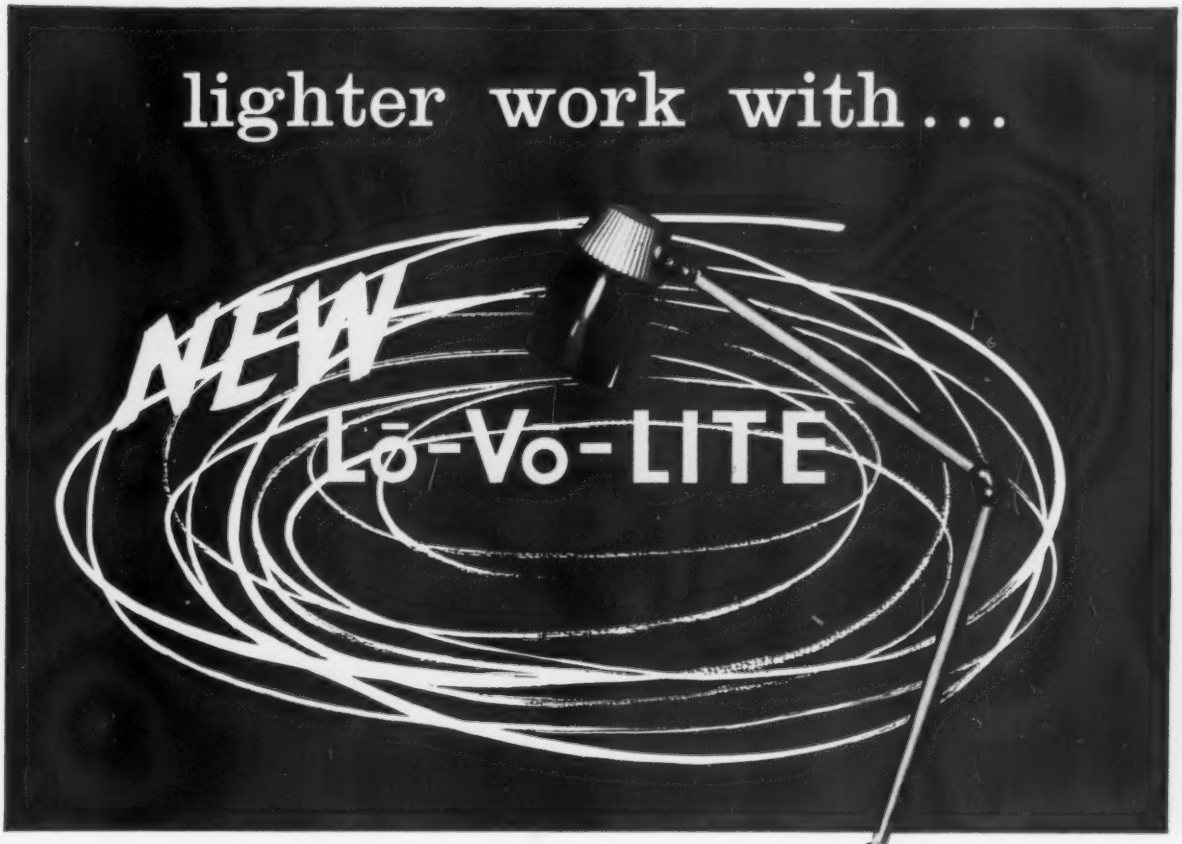

The new Lo-vo-lite has been completely re-designed for compact power, total safety, and modern appearance.

The self-isolating transformer box gives 100 watts, at any of a range of low voltages, from only some 6 x 4 x 4 ins.

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Lo-vo-lite is especially recommended for laundries, bottling plants, and other 'wet' industries.

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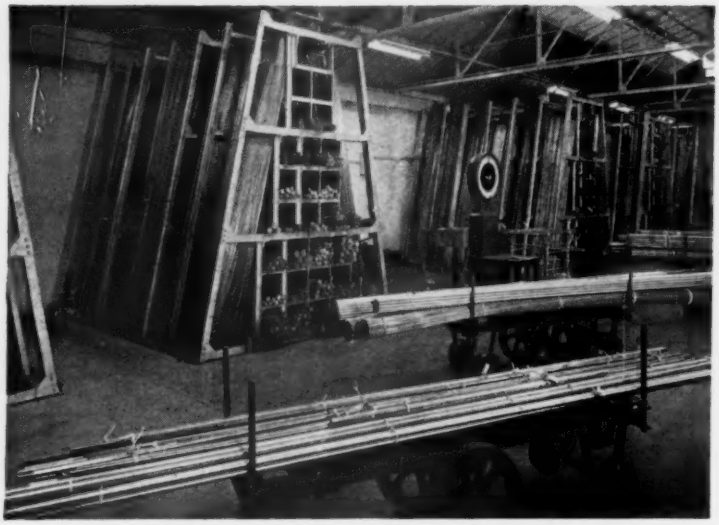

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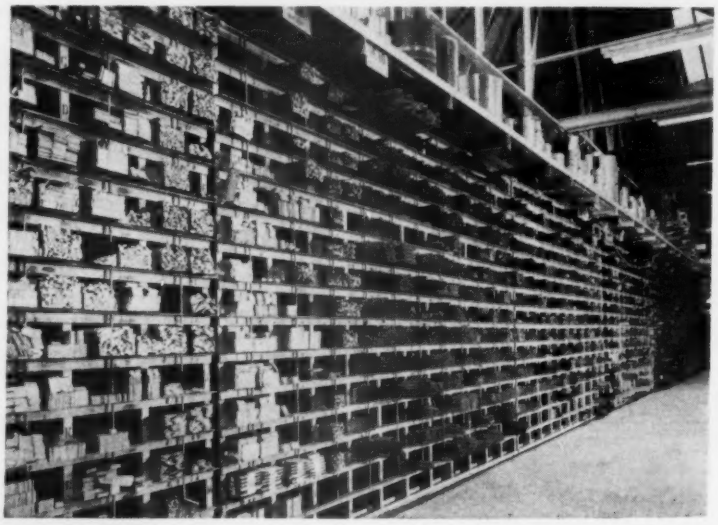

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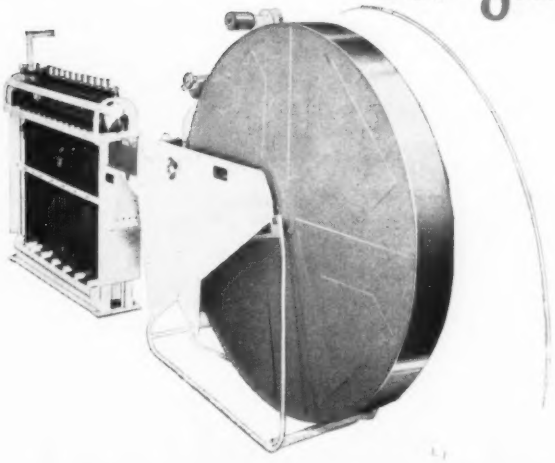

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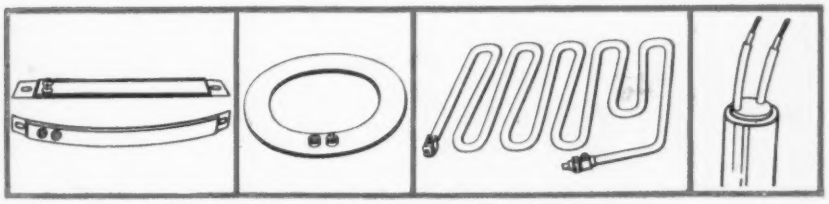

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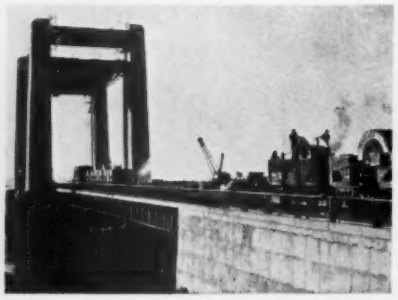

To complete the final and toughest stage of cabling for Stage 1, phase 1, of British Railways' Kent Coast Electrification scheme, the AEI Construction (Cables and Lines) Division had to overcome the intricate problem of taking cables across the Swale.

After leaving the track, the cables were installed — in extremely limited space—on a catwalk under the new Kingsferry Bridge—a new concrete lift bridge which is being built for the Kent County Council by Messrs. John Howard. From the catwalk the cables drop down a 75 ft. deep shaft and through a tunnel under the river bed.

The AEI Construction (Cables and Lines) Division supervised the installation of a 33 kV three-core oil-filled cable and a pilot/supervisory cable made by the AEI Cable Division, and three butyl rubber track feed cables supplied by the Railway.

CONSULTING ENGINEERS:—
Messrs. Mott, Hay and Anderson
9, Iddesleigh House, London, SW1.

Illustrations:
Cables installed in the tunnel under the river. On the right are three signalling and telephone cables with the 33 kV three-core oil-filled cable and pilot/supervisory cable alongside. Cleated to posts on the left are the track feeder cables. The smaller illustration shows the cable train on the new Kingsferry Bridge.

AEI CONSTRUCTION (CABLES AND LINES) DIVISION
Associated Electrical Industries Ltd
59-62 High Holborn · London · WC1
Telephone: CHAncery 2441-9

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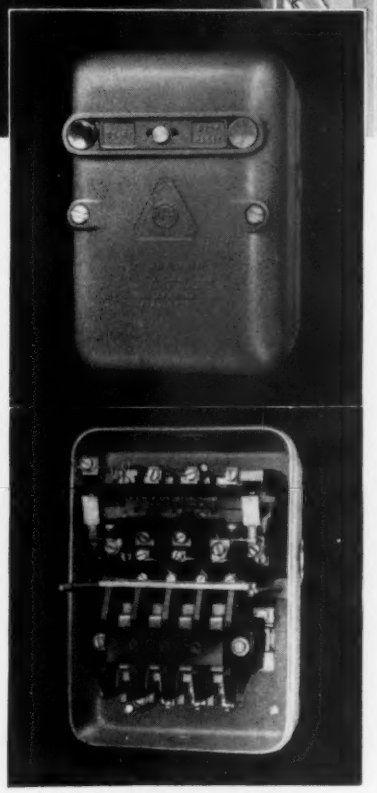

(above) Exterior & interior views of the MF2 auto-switch (for duties up to 7½ H.P.).

Washing 12,500 Jars per hour with EAC Control

Pictured above is the Mayfair dual-line jar washing machine manufactured by the Thomas Hill Engineering Co. (Hull) Ltd., and installed in the works of C. Shippam Ltd., makers of the well-known fish and meat pastes. It rinses 12,500 jars an hour running continuously eight hours per day, five days per week.

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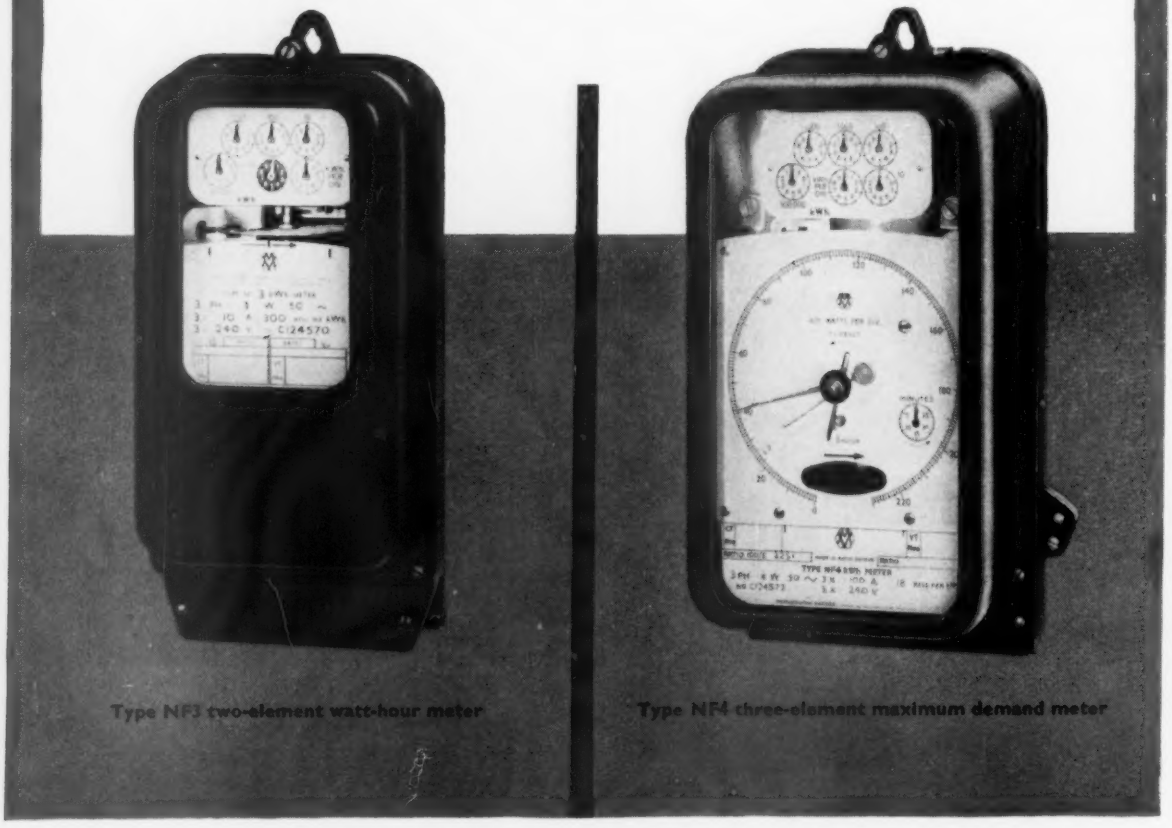

Type NF3 two-element watt-hour meter

Type NF4 three-element maximum demand meter

For further information please write for 'The Art of Metering', which gives full details of these meters.

Associated Electrical Industries Limited

INSTRUMENTATION DIVISION - Instrument & Meter Department

Trafford Park, Manchester 17

G/A 801

THURSDAY 17 MARCH, 1960
Registered as a Newspaper Volume 137 No. 11

ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

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Dans ce numéro

Résistance des isolants de câbles aux impulsions ... 415
La résistance aux impulsions (kV/cm) des papiers normaux ou spécialement préparés pour les câbles à haute tension, ainsi, que celle des produits d'imprégnation (huile ou composés), a été mesurée. La résistance des produits d'imprégnation augmenté rapidement au fur et à mesure que l'épaisseur est réduite au-dessous de 0,13 mm. environ et dans le cas des composés, la résistance est également en fonction de la température. Les améliorations obtenues avec des qualités spéciales de papier lors d'essais de "câbles modèle," sont probablement dues à une modification du mécanisme de détérioration à l'intérieur du produit d'imprégnation lui-même, occasionnée par des changements dans le papier, plutôt qui'à une amélioration des propriétés de celui-ci.

Limites plus basses pour des moteurs à haute tension 425
Les facteurs électriques et mécaniques déterminent le régime de puissance le plus bas pour lequel le changement d'un moteur à tension moyenne en faveur d'un moteur à haute tension est économique. Certaines limites sont suggérées pour diverses hautes tensions.

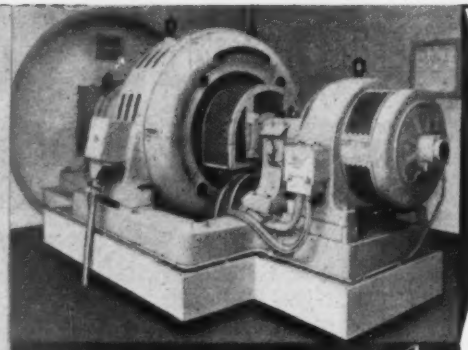
Redresseurs statiques d'énergie 431
A l'heure actuelle l'ingénieur électricien industriel dispose d'un vaste choix de redresseurs statiques, y compris les redresseurs à vapeur de mercure à cuve de verre ou d'acier, à une ou plusieurs anodes et avec ou sans grille commandée, ainsi que les redresseurs au germanium, silicium, selenium ou oxyde de cuivre. En fixant son choix, il sera influencé par des considérations s'appliquant spécialement au problème à résoudre. Ces considérations sont passées en revue dans une étude détaillée, qui se réfère en outre à l'effet de l'alimentation intensive d'entreprises industrielles au moyen de gros redresseurs, sur le système de distribution, par suite de l'introduction de variations harmoniques de tensions.

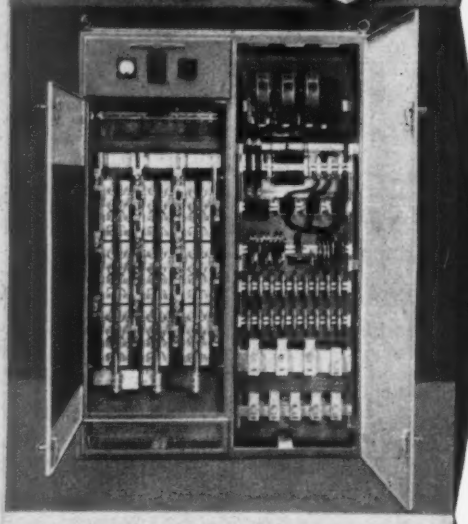
In dieser Nummer

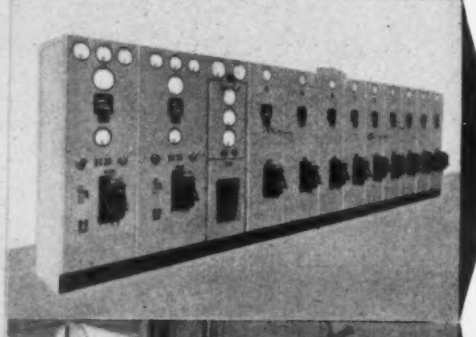
Durchschlagsfestigkeit von Kabel-Isolierstoffen ... 415
Durchschlagsfestigkeit (kV/cm) von normalen und besonders präparierten Papieren für Hochspannungskabel, wie auch die von öligen und gemischten Imprägniermitteln sind gemessen worden. Die Durchschlagsfestigkeit von Imprägniermitteln steigt scharf an, sobald die Dicke auf unter 0,13 mm verringert wird, und im Fall von Imprägniermassen ist die Durchschlagsfestigkeit auch temperaturbedingt. Verbesserungen, die mit Papierspezialsorten bei der Prüfung mit Hilfe von Kabelmodellen festgestellt wurden, sind vermutlich eher auf eine Abänderung des im Imprägniermittel stattfindenden Durchschlagsvorgangs zurückzuführen, die durch Veränderungen im Papier verursacht wurden, als auf verbesserte Eigenschaften des Papiers selbst.

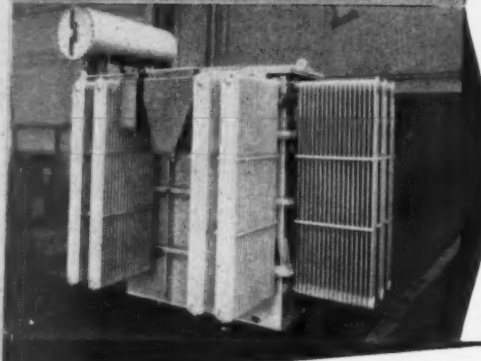
Untere Leistungsgrenze für Hochspannungsmotoren 425
Elektrische und mechanische Faktoren bestimmen die niedrigste Nennleistung, bei der sich der Uebergang von einem Motor mittlerer Spannung auf einen Hochspannungsmotor als wirtschaftlich erweist. Untere Leistungsgrenzen für verschiedene Hochspannungsstufen werden vorgeschlagen.

Statische Kraftstromgleichrichter 431
Dem Konstrukteur industrieller Elektro-Einrichtungen steht heutzutage eine grosse Auswahl statischer Kraftstromgleichrichter zur Verfügung, darunter Quecksilberdampf-Gleichrichter mit einfach- oder vielfach-Anoden im Glaskolben oder Stahlbehälter mit oder ohne Gittersteuerung, Germanium-, Sicilium-, Selen- und Kupferoxyd-Gleichrichtern. Bei seiner Wahl wird sich der Konstrukteur von Erwägungen leiten lassen, die such spezifisch auf das jeweils vorliegende Problem beziehen. Diese Erwägungen werden in einer umfassenden Uebersicht behandelt, die auch auf die Rückwirkungen Bezug nimmt, die Gleichrichtergespeiste, leistungsstarke, industrielle Antriebe infolge des Entstehens harmonischer Spannungen auf das Stromversorgungssystem haben.









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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 17 MARCH, 1960

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K. C. POUNDS, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E.

News Editor
T. W. WRIGHT

Comment

INTERRUPTIBLE LOADS

Off-peak loads have always been encouraged by the bulk supply tariff, through its two-part structure. Now those longer-hour industrial loads that can be shed without serious difficulty are to receive special treatment. The tariff that will apply from 1 April next will make it possible for area boards to quote specially attractive terms to industrial concerns operating processes which can stand a sharp reduction of supply for up to two hours at a time, without deterioration of the product or crippling loss of production. The bait for this arrangement is set high; but only the largest firms need apply. The minimum reduction of load for which arrangements will be made under the tariff is 25 MW, and the supply must be taken directly from a grid substation. There will be a corresponding minimum saving to the area boards concerned of £100,000, for a rebate of £3 19s is offered for normally registrable maximum demand kilowatts taken outside periods that the CEGB chooses to specify (if necessary, at short notice), though the lion's share of the rebate will have to be passed on to the consumers involved. This concession in the tariff continues the move, begun last year, of encouraging desirable loads through a more strongly tilted tariff structure. Last year the kW charge was increased sharply, and the running charge reduced; now the main parameters of the tariff are left unchanged, but the interruptible load feature is introduced—another move to make the tariff more efficient, even if more complex. Overall, there can be nothing but welcome for this recognition of the flexibility of electricity and the implied willingness to pass on to consumers some cash incentive for them to be co-operative. Now it remains with the commercial staffs of the area boards to exploit the possibilities inherent in the new arrangement.

NEW TASKS FOR B.E.A.M.A.

With a changing horizon to European trade and a foreground of restrictive practice legislation at home, all trade associations are having to take stock of their activities. This is equally true of BEAMA but those who have directed its path over the past years have built up a broadly based structure with a widespread field of interest and a stature commensurate with the electrical industry itself. None the less in these changing times, the association itself must change, and in the annual report published this week are reflected some of its rethinking on the problems with which it is assailed. At the international level, new contacts are being made with European associations which appear to be multiplying with every step towards European integration, and representation has even been secured

ELECTRICITY SUPPLY HANDBOOK
The 1960 edition of this publication with completely revised text and area maps will be published on 21 March

on the electrical manufacturers association connected with the common market, thus securing a good lead on political developments towards European unity. At home, with the loosening of the price-fixing strings of the individual associations for which BEAMA provided a core of secretarial service, a new cement must be found for a body that holds together some 80% of the electrical industry. This it is hoped to find in a stepping up of the statistical and information services, for when the unity of mutual trust exists between individual firms through frank interchange of information on turnover, price level and costs, one of the chief causes of excessive price competition is removed. It is in the belief that the basis of such trust exists, that faith in the future of BEAMA is manifest through the pages of the report.

THE RIGHT MOTOR VOLTAGE

There is a general feeling amongst works engineers that a higher voltage motor will be more compact than one for lower voltage, and will present less difficulties in terms of starting restrictions. This is true enough so long as the motor rating required is sufficiently high; but constructional difficulties impose a lower limit to the rating of motors that can be built economically at any given voltage. What these limits are is discussed in an article in the *Industrial Electricity* section of this issue, which may help engineers to appreciate why their inquiries for h.v. motors sometimes receive less than the accustomed warm welcome from manufacturers. Electrical considerations mean that below, say, 150 h.p. for a four-pole motor, medium voltage will be cheaper than high voltage, though the value at which the limit is set will be affected by such factors as type of enclosure and class of insulation used. What may surprise engineers even more than the comparatively large size at which the lower limits for h.v. motors is placed is the author's strongly expressed preference for a transformer/m.v. motor arrangement where a suitable m.v. supply is not available. That this combination can be cheaper than a low-rated h.v. motor is something that can be readily checked but is not universally recognised.

AGGRESSIVE RETAILING BY BOARDS

The Herbert Committee, in its report, was critical of some aspects of electricity board retailing; they thought the boards should be more vigorous in their approach. Since that committee reported, boards have, in fact, made substantial progress in retailing drive, although for reasons other than the committee's remarks. But that progress is not sufficient to satisfy some of the commercial staff in the industry; the case for a more aggressive attitude to board retailing was put by Mr Montgomery, of the Midlands EB, in a forthright paper to the EDA Sales Conference that preached out-and-out competitiveness with other retail outlets, and threw forcefully aside the suggestion that full-blooded retailing might be incompatible with creative load building. Mr Montgomery's plea was for competition with the multiple stores and the radio and TV dealers rather than the electrical contractors and retailers, whom he regards as less significant in appliance dealing. To that end, he called for more appointments to go to men of commercial flair, with perhaps less worry about their standard of technical knowledge. All this had a good body of support at the conference, though by no means universal approbation. The same approach showed itself in other ways, notably with reference to the action of some boards in abandoning the "service centre" title in favour of the blunter "showroom." Of course, any move towards aggressive retailing is likely to demand more capital, and Mr Montgomery's carrot of a doubled profitability through better selling methods is only a partial answer to the difficulties of obtaining this.

SCOTLAND FIGHTS FOR INDUSTRY

Scotland's economic need for more industry to set up within her borders is underlined in the simultaneous publication last week of the reports of the two Scottish Electricity Boards. Both the Hydro Board and the South Scotland Board show their concern to attract more industrialists to operate within Scotland; and both are taking realistic steps to encourage them. The Hydro Board has been the more direct in its methods, as becomes an organisation under a statutory duty to foster the well-being of the residents of its area. It has gone so far as a direct selling approach to industrialists to encourage them to come to Scotland. The South Scotland Board may not have been less effective, although its methods are somewhat more indirect. It has worked hard and, on the basis of results, has successfully built up its industrial advisory service, so that industry within the area can know that if there is an electrical solution to a production problem, the Electricity Board will be knowledgeable and helpful in finding it. The Board has some important developments to its credit, notably in the electrical heating field, and is pressing on with this aspect of its work with the same enthusiasm that has marked its successful campaign to encourage off-peak floor-warming. Yet increase in its energy sales to industry is as low as 2·8%, and that after a 0·7% increase in 1958. The electricity consumption figures paint a grim story of Scotland's plight in this respect, for improvement will require wider help than the boards alone can marshall.

Meteor

This week's quick summary of electrical news faces advertisement page 18.

Surge characteristics

A SURVEY OF TECHNICAL DATA—PART 1

compiled by H. E. Green, B.Sc. (Eng.), A.M.I.E.E.

IN calculating the effect of surges on generating, transmission and distribution systems in accordance with established theory* it is necessary to know the values of certain characteristics, particularly the surge impedance and electrostatic capacitance of individual items of equipment.

It is only very rarely that exact information is available for the particular circuit under consideration and it is therefore necessary to make approximations based on typical figures representing as nearly as possible the plant in question.

There is no disadvantage in this since the waveforms of surges vary considerably and cannot be predicted with any great accuracy, but unfortunately even typical figures for surge impedance, etc., are not readily available, the information being widely dispersed in the literature on the subject. The purpose, therefore, of these notes is to collect together some of this information so that it may be available in a more convenient form.

Overhead Lines

If lightning strikes an overhead line it divides into two parts which travel along the line, half the current flowing in each direction with the speed of light, in the form of "travelling waves." The voltage on the line is equal to the current multiplied by the surge impedance of the line, e.g., a lightning current of 20 kA striking a line with a surge impedance of 300 ohms will produce a surge voltage of 3,000 kV.

The classic work on the measurement of lightning currents by means of magnetic links fitted to transmission line towers was carried out in the 1930's by Lewis and Foust in the United States, Grünewald in Germany and Stekolnikov in Russia.

The statistics published by Lewis and Foust and Stekolnikov are shown in Fig. 1, plotted on logarithmic probability graph paper from which it is seen that the average value is about 20 kA and that only 1% of the strokes exceed 200 kA. The figures published by Grünewald, although more numerous, cover a smaller range and give a slightly lower average value.

A transmission line having a uniformly distributed inductance L henries/cm and capacitance C farads/cm has a surge impedance Z equal to $\sqrt{L/C}$. For a single conductor of radius r cm and a distance h cm above ground the surge impedance is 60 $\log_e$ (2h/r) ohms.

For practical purposes the surge impedance of a transmission line is often taken at 500 ohms. This figure appears to be derived from the early days of (comparatively) low power and low voltage lines and would apply to present day distribution systems. For 132 kV and higher voltage lines the surge impedance is considerably less than 500 ohms. Typical values are given in Table 1.

Waveform

Cathode-ray oscillograms of travelling waves on transmission lines show a wide variety of shapes, amplitudes and duration.

Oscillograms taken in 1928-1930 of lightning surges on a 220 kV line in Pennsylvania (Lewis and Foust, *Trans AIEE*, August, 1934) show that at the mid-point of the line the front of the surge varies from 0·1 to 15 μs with an average of about 2·5 μs, and the time to half crest value on the tail (measured from the beginning) varies from 0·3 to 50 μs with an average value of about 6 μs.

At the end of the line the front varies from 1 to 80 μs with an average value of about 6 μs, and the time to half crest value on the tail varies from 4 to 150 μs with an average value of about 25 μs.

These figures show that in general the waves at the mid-point of the line (average 2·5/6 μs) are shorter, both as to front and tail, than the waves at the end of the line (average 6/25 μs). The difference in length may be accounted for by the waves at the mid-point being recorded nearer their origin. They would tend to attenuate and lengthen out both on the front and tail by travel over the transmission line, but at the end of the line the voltage may be increased by reflection.

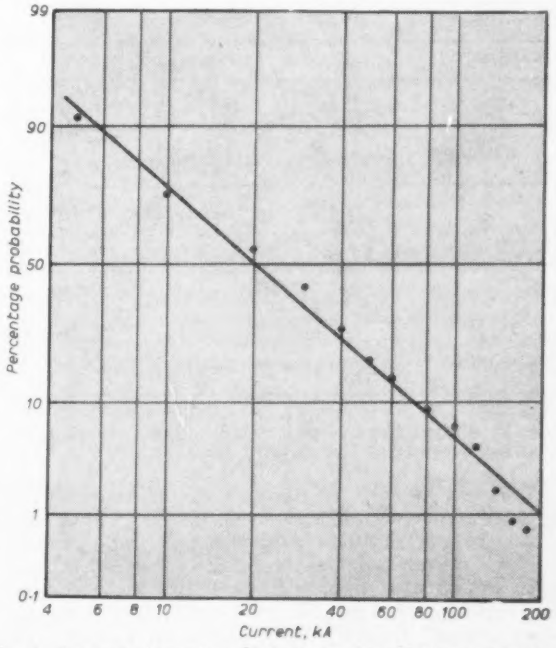

Fig. 1. Frequency distribution of lightning strokes of various amplitudes (Based on data published by Lewis and Foust (1937); Stekolnikov (1938))

* See e.g. L. V. Bewley: "Travelling Waves on Transmission Systems," New York, John Wiley and Sons, second edition, 1951; and J. L. Miller: "The Influence of Certain Transmission Line Associated Apparatus on Travelling Waves," Journal IEE, Vol. 74, pp. 473-510 and pp. 519-535, June, 1934.

Table 1. Surge Impedance of 132 kV, 275 kV, 330 kV and 380 kV Transmission Lines

Voltage	Location	Surge Impedance	Conductors per Phase	Remarks	Reference
132 kV	Great Britain	366 ohms	1×0·4 sq in.		Sayers, Forrest & Lane
275 kV	Great Britain	312 ohms	2×0·175 sq in.		
		307 ohms	2×0·4 sq in.		
330 kV	Rhodesia	314 ohms	2×0·35 sq in.		Winfield Wilcox & Lyon
330 kV	New South Wales	311 ohms	2×0·35 sq in.	Low altitude line	Diesendorf Hurley & Wilson
		314 ohms	2×0·35 sq in.	High altitude line	
380 kV	Sweden	315 ohms	2×525 sq mm		Roser
380 kV	France	335 ohms	2×325 sq mm	1945 design	Gloyer & Vogelsang
		298 ohms	2×510 sq mm	1956 design	
380 kV	Russia	278 ohms	3×480 sq mm		Gershengorn & Luiskov
380 kV	Germany	239 ohms	4×236 sq mm		

References

D. P. Sayers, J. S. Forrest and F. J. Lane: "275 kV Developments on the British Grid System," IEE Paper No. 1309 S.

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H. Roser: "Die 380 kV Ubertragung Rommerskirchen-Hoheneck," *E.T.Z.*, Volume 79A, pp. 1-9, 1 January, 1958.

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A. I. Gershengorn and U. I. Luiskov: "Vvod v Ekspluatatsiyu Linii 380 kV v F.R.G. i Frantsii," Elektrichestvo No. 4 (April), 1959, pp. 87-93.

Table 2. Surge Waveforms

$e = E\,[\exp(-\alpha t) - \exp(-\beta t)]$

Waveform	E	α	β
1/50	101·7	0·0142	6·07
1·5/40	103·2	0·0181	3·54
6/23·5	141·9	0·044	0·46

Table 3. Transformer Surge Impedance

Rating kVA.	Surge Impedance: ohms.	
	H.V.	L.V.
10	12,000	2,200
100	4,000	500
1,000	2,000	200
10,000	1,200	120
100,000	900	100

Reference

A. H. Knable: "Short Cuts in Surge Analysis," Allis-Chalmers Electrical Review, First Quarter, 1957, pp. 30-34.

The data available at the time was also summarised by Müller-Hillebrand (E.u.M., 1936, Vol. 54, p. 361), from which the average values correspond to a 6/23·5 μs wave.

More recently currents in lightning conductors have been measured in Sweden by means of magnetic links and explosive spark gaps (Hyltén-Cavallius and Strömberg, *Asea Journal*, October, 1956), giving an average wave of 2/40 μs with a range of 0·3 to 10 μs on the front and 10 to 100 μs on the tail.

BS 923: 1940 gives the standard wave for impulse testing as 1/50 μs. The American standard is a 1·5/40 μs wave, but the tolerance permitted by BS 923 is sufficient to include the latter value.

Lighting surges may be conveniently represented mathematically by the difference of two exponentials:

$$e = E[\exp(-\alpha t) - \exp(-\beta t)]$$

where E, α and β are arbitrary constants. Table 2 gives the values of these constants for 1/50 μs, 1·5/40 μs and 6/23·5 μs waves. The figures given for E correspond to a peak value of 100 kV.

Reflection of Waves

When a travelling wave reaches a point in a line at which the surge impedance changes, part of the wave is transmitted and part reflected.

Let Z_1 = surge impedance on the incident side

Z_2 = surge impedance on the remote side

e_1 = incident voltage wave

e_2 = transmitted voltage wave or voltage to earth at the end of a line

e_3 = reflected voltage wave

then $e_2 = [(2Z_2)/(Z_1+Z_2)].e_1$

$e_3 = [(Z_2-Z_1)/(Z_1+Z_2)].e_1$

If a line terminates at an apparatus of high surge impedance and Z_2 is large compared with Z_1, then $e_2 = 2e_1$ and $e_3 = e_1$ approximately.

Transformers

A transformer at the end of a line may present a high surge impedance depending on its rating and voltage since these factors determine the number of turns in the winding. Its surge impedance will also be different on the secondary side depending on the number of turns in that winding. Typical figures for transformer surge impedance are given in Table 3.

(To be concluded)

HIGH-GAIN D.C. AMPLIFIER

DESCRIBED in a paper presented to the IEE Measurements and Control section last Tuesday is a transistor chopper-type d.c. amplifier intended for use in the field of process measurement and control. The amplifier is characterised by low drift combined with high gain and a large dynamic range. A.C. gain prior to the demodulator is only 50 V/microvolt, the remaining voltage gain of about 200 being provided by a low-drift d.c. amplifier connected as a feedback integrator, and used to smooth the demodulator output. This arrangement is claimed to enable the system to handle, with minimum saturation, the large error signals which occur during a rebalancing operation, and thus maintain a fast response to large changes of input signal. (Paper 3227.)

New look for B.E.A.M.A.

CHANGING CONDITIONS REFLECTED IN ANNUAL REPORT

SOME serious heart-searching has been done by BEAMA in the past year on the bearing that the Restrictive Trade Practices Act will have on the work of the Association. As a result, it has been concluded that the declared objects and basic organisation of BEAMA are well suited to the tasks that lie ahead. This is made clear in the annual report that is published this week. Stress is placed on the Association's facilities for full and frank exchange of information between members and the provision of statistics and commercial intelligence as a guide to trading activities. It is felt that the lack of information on turnover, price levels and costs is one of the chief causes of excessive price warfare. Without unity in the industry or an interchange of full information, there is always a danger of irresponsible price competition.

In reviewing the past year, it is pointed out that the electrical and allied manufacturing industry has attained a record output of around £1,400 million or about 9% above the previous year. The most striking increases have been achieved in the domestic appliance field, but on the heavy side deliveries of turbo alternator deliveries reached the record level of 4,000 MW, both total production and export being higher than in any previous year. The industry retains its position as a leading exporter with a total of £285 million, representing over 10% of total UK exports of manufactured goods. Against such figures, there is every confidence expressed in the inevitable growth in demand. Price competition has, however, become keener and the trend towards narrower profit margins is likely to continue. A warning is given of the possibility of price levels being reduced to the point where they do not provide sufficient margin for re-equipment, research and technical development.

Work of the Sections

In discussing the work of the sections of BEAMA, attention is called to the tendency for sections having a common interest to work together. The outstanding example of this is to be seen in the formation of Domestic Appliances Division during the year. This is an authoritative body comprising six sections covering individual classes of appliances. It has already been active in the collection and publication of statistics of electrical appliances on behalf of the whole industry. With the importance attached to exports in this field, the Division arranged a special export conference in February this year. Another far-reaching step taken during the year has been participation in the setting up of a provisional British Electrical Approvals Board for Domestic Appliances. This representative body will take over from EDA the existing list of approved appliances, and will institute procedures for testing and approval of appliances and the issue of a suitable mark for such appliances.

Activities amongst the other sections have been widespread. A special study has been initiated by the Dynamo and Motor Section into the possibilities of increasing exports in the EFT area. The Transformer Section has had discussions with the NCB on the specification of a dry-type transformer for operating close to the coal face and the Traction Section has been co-operating with British Railways in a conference and exhibition to be held later this year. The question of adequate wiring particularly interests the Accessories and Small Switch and Fuse Gear Sections who are promoting a campaign to secure proper equipment of domestic installations. However, they feel that the time has come for a more positive national campaign on this theme.

Export Activities

To signal the importance it attaches to the export field, BEAMA has set up an Export Division to take over the work of the export department.

The export panel which has been established for ten years, has now been enlarged to form the main committee of the Association. One of its important activities will be to continue the liaison work with the BEAMA overseas committees which do such valuable work in markets abroad. In the European field, a special survey has been made by an economist of the Common Market and it is now ready for publication. BEAMA is also taking part in another European organisation, the Organisme di Liaison des Industries Metalliques Europeennes, a forum for the chairmen and directors of trade associations of 14 European countries which is said to afford "fascinating glimpses of the diverse interests and practices of trade associations in different countries." A similar body has been set up confined to the EFTA.

With 2,000 representatives on over 600 BSI committees, there is no doubt of the seriousness with which BEAMA views the subject of standardisation. The standards department has been reorganised and strengthened and provision made for early interchange of information between the many technical committees. At the international level the view is taken that it is more than ever important that a British electrical industry policy be established and expressed at the initial stage of international discussions.

The information services are a primary function of the Association and under this head, the collection of statistics is likely to form a major part of the work in the future. Amongst publications, improvements for the BEAMA Bulletin are under consideration, and the future form of the BEAMA Catalogue is being studied.

On the question of the supply of materials, the committee responsible, together with the DAD, has been concerned with the supply of mild steel sheets for appliances. They have notified the Iron and Steel Board that a 20% per annum rate of increase in requirements is likely to persist for the next four or five years and has asked for a longer term of exemption from duty on imports, say to the end of 1963. The supply position of cold-reduced oriented electrical transformer sheet is much easier, nevertheless, transformer makers are not completely satisfied in regard to quality.

Supply in Scotland—1959

SCOTTISH ELECTRICITY BOARDS REPORT PROGRESS

UNLIKE the English and Welsh electricity boards, the South of Scotland EB and the North of Scotland Hydro-Electric Board use the calendar year as their accounting period. Last Friday saw the publication of their annual reports for 1959, a year in which Scotland recovered but slowly from the industrial set-back which had been most serious in the previous year. This economic circumstance is reflected in the electricity supply results which we summarise below, though to different extents for the two boards.

In comparing the results recorded, it needs to be borne in mind that there are differences of definition and of accountancy practice between the one board and the other; so figures that seem comparable may not in every case be so in rigid analysis.

South of Scotland E.B.

SALES of electricity by the South of Scotland EB during 1959 were 7·4% up on those in the previous year. This is stated in the Board's annual report, published last Friday. Trading income for the year was £41·1 million, on which the modest surplus of £97,147 was realised. During the year the Board spent £27·4 million on capital account. These are the leading statistics from the report, more are given in Table 1.

Commercial Progress

For the South of Scotland Electricity Board, 1959 had three characteristics: a prolonged and severe winter, a warm, dry summer and a delayed recovery from the industrial recession of the previous year. Reflecting the latter condition, industrial sales rose by only 2·8% as against a 9·3% increase in sales to domestic, farm and commercial consumers. In the previous year, industrial sales had increased only 0·7%.

In the face of this low rate of increase, the Board has been active in encouraging electrical applications in industry through its Industrial Advisory Service; and it is now establishing an industrial research and development workshop where facilities will be available for trials of electrical plant and methods, and for research into unusual aspects of industrial applications of electricity. Already the Board has achieved considerable success in the high temperature heater it has designed for preheating large pressure vessels prior to welding, and it has now drawn up a specification for a new type of electric furnace with exceptional low capital and running costs for stress relieving production runs of small pressure vessels.

Undoubtedly one of the outstanding successes of the Board has been in development of off-peak loads. The extent of the load is shown in Table 2, and it is notable that 64% of the installed off-peak load is for space heating, with furnaces coming next at 13%. About 30 local authorities in the area have adopted off-peak electric floor-warming (in conjunction with off-peak electric water heating) for some 7,500 all-electric dwellings. There are 160 schools using this method of space heating and 24 more in course of erection. One effect of this development is that off-peak loads are believed to have improved the load factor from an estimated 45·1% if they had not existed, to 46·5% (these figures are after correction for normal weather conditions; the actual load factor was 46·8%).

Sales of appliances by the Board reached a record total of £3·9 million, compared with £2·6 million in 1958. Increases in sales of appliances over 1958 were: cookers 22%; washing machines 82% and refrigerators 146%. The five-year programme for rural development "was virtually completed" by the end of the year, nine months ahead of schedule. At that time, 93% of all farms in the Board's district were supplied or in process of being connected.

Engineering

Peak system demand during the year was 1,750 MW on 5 January, an increase of 7·56% over the 1958 demand. At the time of maximum demand 88·5% of the total plant capacity was available, and the Board was importing 369 MW from the N of S HEB and 34 MW from the CEGB. During the year as a whole the Board generated 80·9% of its energy requirements, compared with 86·2% in the previous year. 60·7% of units generated came from four stations with relatively high thermal efficiency—Kincar-

Table 1. S of S EB Results for 1959

		1959	1958
Commercial			
Units sold			
Domestic	million kWh	2,116	1,918
Farm	million kWh	140	130
Commercial	million kWh	993	924
Industrial	million kWh	2,961	2,879
Public lighting	million kWh	119	119
Traction	million kWh	96	20
Total	million kWh	6,435	5,990
Number of consumers	million	1·342	1·321
Engineering			
Generation			
Steam capacity	MWi	1,649	1,535
Hydro capacity	MWi	123	123
Total capacity	MWi	1,771	1,658
Thermal eff.*	%	26·14	26·07
Energy s.o.	million kWh	5,806	5,779
Transmission, etc.			
Substation capacity	MVA	9,479	8,379
OH lines	circuit miles	12,651	12,047
UG cables	circuit miles	17,111	16,612
Financial			
Income			
Sales of elec.	£m	40·22	36·80
Surplus on cont. & sales of fittings	£m	0·55	0·22
Total income †	£m	41·06	37·34
Expenditure			
Generation	£m	20·88	19·57
Interchange	£m	5·35	4·22
Trans. & distn.	£m	9·41	8·55
Cons. service	£m	1·45	1·34
Meter reading, etc.	£m	0·75	0·72
Admin, etc.	£m	1·27	1·16
Research & dev.	£m	0·07	0·04
Rates	£m	1·60	1·52
Total expenditure†	£m	40·96	37·27

*Excluding Barony slurry-burning power station. †Including other items

dine, 32·60%; Portobello H.P., 31·17%; Dalmarnock H.P., 29·88% and Braehead, 28·54%.

Good progress was made during the year with preliminary work on the 275 kV system. As part of reinforcement for Glasgow approval was given to a 3½ mile double circuit 275 kV cable connecting the supergrid to the city centre. Another important plan was for a 60 MW connection from the 275 kV supergrid to the steel strip mill to be built at Ravenscraig. This will involve a further 2½ miles of double circuit cable. Amongst technical developments in the transmission field were installation of an electronic recorder to locate any faults occurring on the Clyde's Mill-Harker 275 kV line, and introduction of a new design of 132 kV double circuit tower incorporating tubular steel members.

The Board has an extensive research programme in operation, much of it concerned with the utilisation techniques already discussed. In the transmission and distribution field, subjects under investigation include:

Design of large variable shunt reactance transformers.
Design of insulator strings to prevent clashing of conductors on twin 0·175 sq in., 275 kV lines.
Treatment of wood poles.
Design and arrangement of underground transformers.
Design and arrangement of transformer street pillars.

In the generation field, research has been concentrated on the interaction of the Board's activities and local natural history: the effect of Hunterston on marine biology in the Firth of Clyde, the effect of afforestation on operation of the Galloway Hydro Scheme, and fishery matters in the Galloway area. In the utilisation field, it is off-peak applications that provide the bulk of the work, with attention to the heating of roads, heating of buildings, and applications in agriculture. New street lighting techniques are also being studied, and the work on stress relieving already mentioned comes properly under the research heading.

Table 2. Off-peak Development by S of S EB

Class of consumer	MW added during 1959	MW at end-1959	Units sold 1959 (millions)
Domestic	8·73	21·25	14
Farm	0·93	6·47	8
Commercial ...	39·00	132·08	116
Industrial	7·17	65·47	67
Total	55·83	225·26	205

Finance

The relatively small surplus achieved is attributed to the sag in growth of industrial expansion and the exceptional weather conditions which limited the continuing growth in domestic consumption. These circumstances led to the conclusion that even with continuing technical and administrative improvements, existing tariff levels were no longer sufficient to maintain a stable technical foundation for the Board's activities.

One notable feature in the year's accounts is that cost of fuel per ton, adjusted for calorific value, fell for the first time for many years, being 93s 4d in 1959 compared with 95s 9d in 1958.

Capital investment during the year totalled £27·4 million, of which £10·7 million was on account of Hunterston nuclear power station. The report comments that although the Board intends to charge all interest directly to revenue as usual, the magnitude of the burden associated with Hunterston merits recognition. During 1959 the Board met 26·7% of its capital requirements from internal resources.

Consumer billing in the South of Scotland is carried out on the basis that one of the quarterly bills each year is based on an estimated meter reading. During 1959 some 850,000 bills were sent out on this basis, and experience suggests that this procedure is "generally acceptable" to consumers, besides offering economies to the Board. Later this year (1960) billing by electronic computer will begin in some areas.

North of Scotland H.E.B.

SALES of electricity to consumers in the North of Scotland area during the first three-quarters of 1959 are described as "disappointing" in the annual report; but there was a recovery during the subsequent part of the year. In the result, sales of electricity to consumers in the area were 5·3% up on the previous year. Trading income for the year was, despite this, slightly below outgoings, and a deficit of £29,170 was recorded on a turnover in excess of £15 million. Table 3 gives statistics in more detail.

Commercial Results

The dry weather that occurred in the South of Scotland also marked the year in the north. Domestic consumers took 8·4% more energy, and industrial consumers 8·5%. During the year, all tariffs except those for off-peak supplies were increased by 5%.

So far as domestic consumers were concerned, the easing of credit restrictions showed itself in a sharp increase in sales of appliances to 41% above the previous year's turnover. The report records "a marked increase in the popularity of all-electric houses," with 343 local-authority dwellings of this kind already built and 1,038 under construction at the end of the year. It is claimed that a "large majority" of local authority housing tenants choose to cook by electricity when they have a choice.

Commercial consumers are also showing increasing interest in the use of electricity for space heating and catering.

The Board takes an active part in attempting to attract industry to the north of Scotland, and they make direct

Table 3. N of S HEB Results for 1959

		1959	1958
Commercial			
Units sold			
Domestic	million kWh	618	570
Farm	million kWh	118	114
Commercial	million kWh	287	275
Industrial	million kWh	369	340
Public lighting...	million kWh	16	14
Traction	million kWh	—	1
To S of S EB	million kWh	550	—
Total	million kWh	1,971*	1,812*
Number of consumers	million	0·384	0·374
Engineering			
Generation			
Steam capacity	MWi	133	133
Hydro capacity	MWi	866	813
Diesel capacity	MWi	48	50
Total capacity	MWi	1,047	955
Energy generated	million kWh	2,196	2,043
Transmission, etc.			
OH lines	circuit miles	16,077	15,085
UG cables	circuit miles	2,675	2,598
Financial			
Income			
Sales of elec.	£m	13·86	12·70
Surplus on cont. & sales of fittings ...	£m	0·24	0·17
Expenditure			
Generation & purchase	£m	8·02	7·11
Trans.	£m	1·22	1·09
Distn.	£m	3·46	3·34
Cons. service	£m	0·07	0·06
Management & general	£m	0·77	0·76

*Includes units used in construction of h. e. schemes

approaches to manufacturers. These are now producing a "hopeful response." 103 new industrial consumers were connected during the year.

On average, domestic and crofting consumers paid 1·70d/unit during the year, and industrial consumers 1·63d/unit.

Because of the dry weather, thermal generation was necessary both early and in the autumn, and it had to be supplemented by increased imports from the S of S EB. Export to the S of S EB during the year amounted to 550 million units, including 68 million additional and spill units; imports from that board totalled 89 million units.

Engineering

Maximum output during the year for the HEB system was 468 MW; maximum export to the S of S EB, 404 MW; and maximum simultaneous generation, 861 MW. The three peaks occurred on different days, and at 5 p.m., 5.30 p.m. and 5 p.m., respectively.

During the year, 53 MW of hydro sets was commissioned. There was no addition to the steam plant, nor to the diesel plant. Experience with the experimental gas turbine sets was disappointing. Trials at Dundee were abandoned "as all indications were that reliable commercial operation was unlikely." Test runs at Altnabreac with a peat-fired gas turbine continued, with modifications to the set to reduce vibration trouble. During the year, the plant ran 1,017 hours, generating 301,000 units and burning 433 tons of peat.

During the year, the Loch Awe scheme for a 400 MW pumped storage station got under way. Exploratory borings confirmed the possibility of an arch dam at the upper end of the Upper Glen Nevis gorge, and for a further dam at the outlet of Loch Laidon. Longer-term investigations have included the River Tay at Kenmore and Grandtully, and the River Snizort in Skye. There have been initial tests of the effect of using Loch Lomond for a pumped storage scheme,

The Board are still considering the possibility of bringing a nuclear station into operation in the late 1960s.

Construction work on the transmission system during 1959 was mainly concerned with the 132 kV lines, but contracts were placed for 270 miles of line for working at 275 kV, and wayleave negotiations were in hand for the 275 kV line to connect with the Lock Awe pumped storage scheme. Operational experience during the year was marked by a relatively short duration of weather in which icing on lines was experienced. Heating current was applied to melt the ice on some lines over high passes, with good results in one case, and less success in another. In the latter case it was decided to provide conductors of smaller cross section, so that the effectiveness of the heating currents could be increased.

Research and development work during the year has included application of digital computer techniques to determine the best way of operating hydro and thermal plant jointly, in terms of regulation of storage. There have also been tests at hydro stations on direct switching-in of generators, with the object of assisting the design of reversible pump-turbines for future pumped storage installations. Other investigations have as their object determination of the thermal effects on alternators of operations at low leading power factors, to supply line charging currents.

Financial

Capital expenditure by the Board during 1959 totalled £13·0 million. During the year £3·0 million was set aside for depreciation and other capital provisions.

A change in the Board's practice which has made results seem better than they might otherwise have done is abandonment of the conservative practice which had been followed, of spreading forward into later years a proportion of the profit on h.p. business. They have now fallen into line with other boards, by taking credit for profit at the time h.p. agreements are signed.

The deficiency on the year's working brings the aggregate deficiency of the Board to £753,626.

MOUTH-TO-MOUTH RESUSCITATION

DIRECT mouth-to-mouth breathing as a method of artificial respiration has gained acceptance in the USA, where the Edison Electric Institute is amongst organisations to adopt the technique officially. It is claimed that it works better ventilation of the unconscious Nielsen techniques. Advantages claimed for the mouth-to-mouth method include better ventilation of the unconscious victim's lungs; facility for the operator to observe the victim's chest movements; less energy expended by the operator; and absence of need for any careful training.

The technique adopted is to tilt the victim's head back as far as possible after clearing the throat of water, mucous and other foreign matter. The thumb should then be inserted between the victim's teeth, grasping the lower jaw and lifting it outward and up higher than the upper teeth. The purpose is to free the tongue in the throat to allow air to pass into the lungs. Next the victim's nose must be pinched to prevent air escaping from the nostrils. After these steps have been carried out, the operator should position his mouth as shown in the sketch, and blow vigorously into the victim's mouth at a rate of about 12 breaths a minute.

The mouth-to-mouth position for the Abraham breathing resuscitation technique

For children, more gentle breathing should be adopted, but the rate stepped up to about 20 breaths a minute.

While the blowing is taking place, the operator should observe the victim's chest, to ensure that it is rising and falling—an indication that the air is finding its way in. It is suggested that the first few breathes should be more rapid than the mean rate suggested, in order to build up oxygen. As with all artificial respiration methods, it is necessary to keep up the treatment; the victim may well not reach a stage where he can breathe himself for a long time.

Although the US organisations are strongly backing this method of artificial respiration (sometimes called Abraham breathing) they also emphasise the advisability of being familiar with the established methods, in case the victim is burnt or injured about the face.

We are indebted to *Synchroscope*, staff magazine of the Detroit Edison Co., for the illustration and the instructions for applying this technique.

Cables under impulse stress

IMPREGNANT STRENGTH SUGGESTED AS FAILURE CRITERION

EXACTLY how failure occurs in a pressure cable dielectric under impulse voltage stress is a matter of controversy. But an understanding of this mechanism is becoming increasingly urgent with the expanding use of these cables.

The opinion expressed in a paper presented before the IEE last week* suggests that failure depends principally on the dielectric strength of the impregnant. Variations in the properties of paper wrapping tapes used certainly affect the impulse strength, but only by modifying the stress in the impregnant and not by an increase in their own inherent strength.

The authors base their conclusions on a large number of tests performed on different grades of normal paper tape and also on specially prepared paper, as well as on impregnants and "model cables."

Paper Under Stress

Impregnated paper is still the most suitable material for insulating high voltage cables although for low voltage applications polythene is being increasingly used. Accordingly, considerable attention is given by the authors to an examination of the three principal factors likely to influence behaviour of paper under impulse stress: they are the density, air impermeability and thickness. In the tests six paper tapes, $\frac{1}{4}$in. wide, having 75/25% registration and with $\frac{1}{16}$in. butt-gaps, were lapped onto a smooth 1in. diameter copper tube. This tube formed the inner electrode in the test, while the outer electrode consisted of a single sheet of metallised paper wrapped over the dielectric. Before testing, the models were dried for 48 hours at 100°C under a vacuum of 0·2 mm of mercury, and then impregnated with degassed oil or compound. Tests were performed at 85°C, as it is generally accepted that breakdown strength deteriorates as the cable temperature is increased. An examination of 46 samples of paper, impregnated with either rosin-compound or normal viscosity cable oil, suggests that an increase in paper density alone results in a reduction in impulse strength. The samples used in this test were 5·6 mil thick with a density of 0·67 g/cm^3, and 5·4 mil with a density of 0·8 g/cm^3, respectively.

Further tests on papers with approximately the same thickness and density, but with air impermeability as measured by the Emanueli method of 1·5 and 30 million units, showed that increasing the air impermeability with viscous impregnants had little effect on the impulse strength, but with low viscosity impregnants an appreciable increase in impulse strength was apparent.

Paper thickness is the third important factor, and the authors confirmed previous experience that impulse strength (kV/cm) increases quite considerably as thickness is reduced.

Further tests carried out with specially prepared papers supported these conclusions and also indicated that the effect of air impermeability is related to viscosity of the impregnant. An increase in air impermeability gave a considerable improvement with low viscosity impregnants, but little change with viscous impregnants.

Tests on Impregnants

Most striking feature of the behaviour of impregnants under impulse stress is the sharp rise in electrical strength for thickness below 5 mil. Although temperature has an important bearing on the impulse strength of rosin and polyisobutylene containing compounds, the results indicate that its effect on oil is practically negligible. In plotting their results for oil and compound, the authors based their curves on the mean value of at least 20 samples for each thickness tested. The largest divergence of these mean points from the curve was less than 10%. The results were obtained in a special test cell devised by the authors.

Impulse strength of oils can be increased by certain additives, one of the most suitable being 2% 8-hydroxyquinoline. However, as shown in Fig. 2, the improvement decreases as the dielectric thickness is reduced, and below

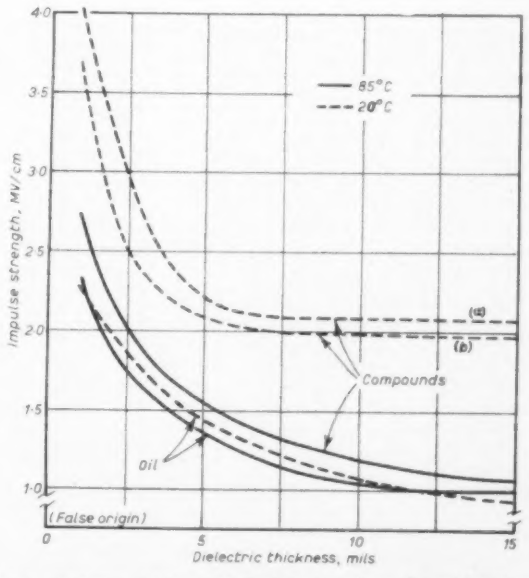


Fig. 1. Variation of impulse strength with thickness for cable impregnating oils and compounds at 20°C and 85°C. Only slightly different values were obtained for oil-filled cable oil of normal and low viscosity, and they are plotted as a single curve. Compound curves differ appreciably at 20°C as shown. Curve (a) is for compound with a rosin content, and curve (b) for a polyisobutylene content

* Paper S 3143: "The impulse strength of impregnated-paper dielectrics as used in high-voltage cables," by B. Salvage, B.SC.(ENG.), PH.D., M.I.E.E., and J. A. M. Gibbons, B.SC. Dr Salvage is in the electrical engineering dept., Leeds University, and Mr Gibbons is with the CEGB. Both were formerly with W. T. Henley's Telegraph Works.

5 mil, a thickness comparable with the butt-gap in lapping paper tapes, there seems little advantage in its use.

Conclusions

For paper it would seem that increasing the air impermeability yields improved impulse strength, but increasing thickness and density both have an adverse effect. This conclusion suggests that although super-calendering paper will increase air impermeability, the effect is counterbalanced by consequent reduction in strength resulting from the increased paper density. The decrease in impulse strength with increase in paper density found on both model cables, and cables in which allowance has been made for any permittivity grading in the dielectric, is consistent with increased permittivity of the dielectric and hence higher butt-gap stresses.

An explanation for the sharp rise in impulse strength of impregnants with reduced thickness is offered by the authors. As multiplication of electrons by impact ionisation is the principal cause of breakdown in liquid dielectrics, it is suggested that gaps below 5 mil are too small to permit spatial development of the electron avalanche.

There is little doubt that breakdown is initiated in the impregnant-filled butt-gaps between adjacent paper tapes, since the permittivity of the cellulose fibres is two or three times that of the impregnant. It is likely that in solid-type or gas cushion cables at ambient temperatures, breakdown begins at a butt-gap adjacent to the conductor, field distortion follows and complete breakdown is rapidly propagated throughout the dielectric. However, at elevated temperatures the process would seem to be influenced by the air impermeability of the dielectric, and consequently to be more complex.

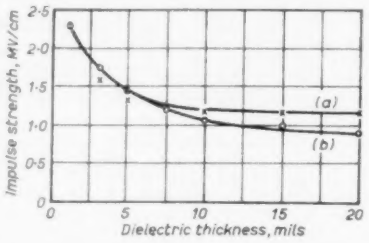


Fig. 2. Adding 2% 8-hydroxy-quinoline increases the impulse strength of normal viscosity oil-filled cable oil as shown by the upper curve

DISCUSSION

The discussion was opened by Dr A. L. Williams (BICC) who expressed some disappointment that in his opinion the work reported in the paper seemed to have been done some years previously. He felt that little advance had been made in clearing the controversy concerning the effect of paper density. Until recently, emphasis in design had been concentrated on increasing the dielectric strength to comply with impulse test requirements, but the tendency now was to attempt reductions in dielectric losses while still maintaining impulse strength. Losses can be reduced by reducing paper density, but this may well lead to considerable problems for the manufacturer. A previous paper suggested that separation of the effects of density and impermeability was impracticable and the authors seemed to base their conclusions in this respect on slender evidence since they tested only two types of paper. Were they therefore, justified in attributing the differences they obtained to density alone?

Mr C. C. Barnes (CEGB) referred to some important additions which the CEGB had made in their impulse testing requirements. It was now recognised as essential that all cable accessories and terminations should be tested as one assembly, requiring adjustment of the impulse generator to meet the varying cable characteristics. Cables were subjected to a bending test before impulsing and were tested at working temperature plus 5°C. He asked why the authors had chosen to conduct many of their tests on normal viscosity oil when, for a number of years, it had been standard practice to use low viscosity oil.

Mr D. H. Booth (Glovers) expressed disappointment at finding little reference in the paper to high-pressure oil or gas systems. The gas systems in particular imposed some complex problems. In tests on gas fillings it had been found that a pressure rise from 30 to 200 lb/sq in. gave about a 40% increase in impulse strength. In tests on butt-gap filling media they had found some significant results with different gases, for example while nitrogen gave impulse strengths of 850 kV/cm, for sulphur hexafluoride the figure was 1010 kV/cm.

Mr D. J. Skipper (CEGB) felt unable to agree with the author's contention that breakdown was initiated in the butt-gap impregnant. In his opinion, the most likely seat for breakdown was the oil to paper interface since there, the average stress would be similar to that in the adjoining paper. For this reason permittivity grading and breakdown strength of paper was important.

Influence of pulp beating on the paper characteristics was emphasised by Mr E. Kelk (BICC). He also suggested that the authors had not allowed sufficiently for variations in paper thickness in coming to their conclusions on the effect of paper density.

Dr J. H. Mason (ERA) asked what measures had been taken by the authors to check moisture content of the papers. Tests conducted at ERA on papers for capacitors showed moisture content had a very great bearing on their strength, especially on the inception stress for occurrence of ionization.

Mr A. M. Morgan (Enfields) supported the authors' views on the effect of creasing, by describing tests on two similar cables, one with tightly wound tape and consequently creased. This cable showed an impulse strength about 7% higher than the other cable with normal lapping.

Dr F. J. Miranda (Pirelli-General) noted agreement in the authors' paper with previous publications. He asked whether the effect of sharp edges on the screening paper had been considered.

Mr G. E. Bennett (Dussek) said that tests had shown that copper is easily pitted by impulse waves and he had used stainless steel electrodes for this reason.

Mr E. H. Ball also queried the use of metallised paper as the outer electrode.

Mr R. E. James (AEI) asked for details of the detection equipment used and whether detection of incipient breakdown had been possible.

Dr T. J. Lewis (Queen Mary College) outlined some work being undertaken on oil and liquid argon. In both cases they had concluded that breakdown mechanism was extremely complicated. There was clear evidence that small particles initiated the process. He suggested that residual gas in the paper fibres might prove to be very important.

In reply, Dr B. Salvage, underlined the importance of paper density and said that, in the course of their investigations, over 1,000 models had been tested. The comments in the paper were not necessarily applicable to gas-filled cables. In preparing the cable models, a single sheet of metallising paper had been used, which effectively prevented trouble from sharp edges. He pointed out, in answer to Mr Barnes, that their tests had shown little difference in behaviour of normal and low viscosity oils. He agreed that they had used an open test cell and there was a possibility of some discrepancy due to gas absorption from the atmosphere, although this had been reduced to the lowest practicable value.

Load building, appliance retailing

E.D.A. CONFERENCE CONCLUDES WITH STUDY OF SUPPLY INDUSTRY PRACTICE

ELECTRIC heating, may, no doubt have been the preoccupying thought of many delegates as the EDA Sales Conference got under way in a flurry of snow last week in Harrogate. The sudden drop in temperature, however, did nothing to diminish the success of this event, with the exhibition providing a touch of sparkle. In fact, the new addition seems already to have established itself as a logical partner to the conference; it offers an opportunity which the BEPC show could perhaps not always provide, that of a meeting ground between manufacturer and commercial staffs exclusively. Both exhibitors and delegates regarded the show as worth while.

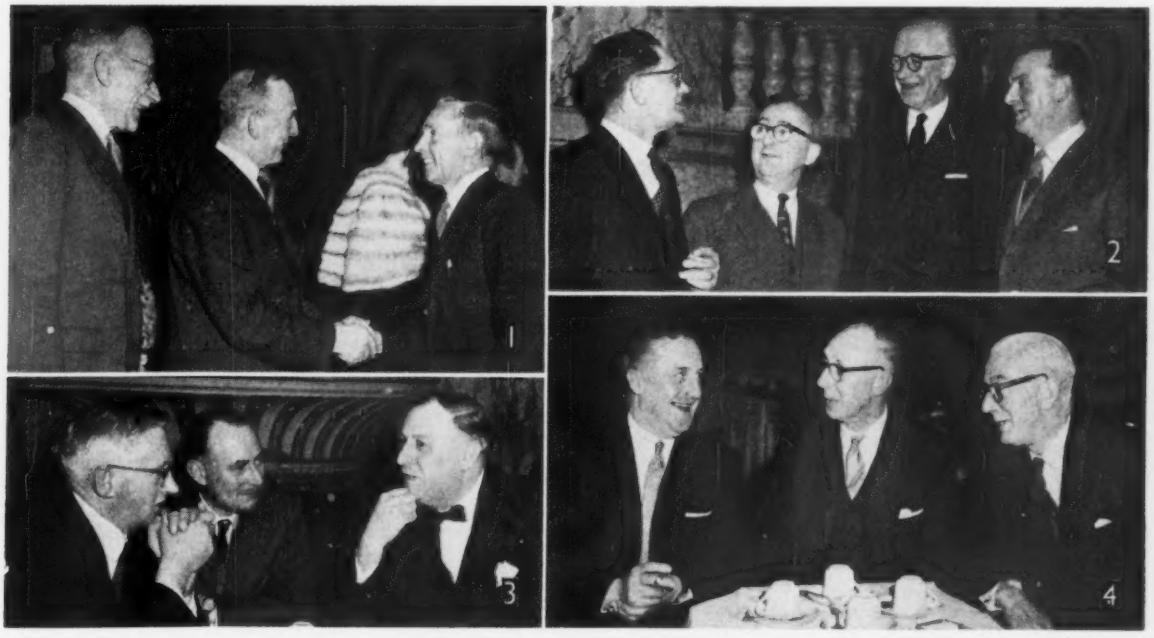
If heating had been in delegates' minds, they were provided with the opportunity of expressing their thoughts on Thursday morning, where, with the paper presented by L. Shepherd, B.SC.(ENG.), M.I.E.E., we take up the thread from last week's issue. There, it will be recalled, we reported on the Tuesday and Wednesday papers; the discussion they provoked is dealt with briefly on page 420.

Although floor-warming, as a topic for discussion has been worked over both extensively and intensively in the last year or so, Mr Shepherd indicated that the last word has by no means been said. It would, in fact, be surprising if it were otherwise. If nothing more, his paper provides a valuable design reference at a time when the industry's attitude to design is being re-examined; it also provides a useful reminder of insulation, and installation, practice.

Design itself is primarily an accurate assessment of the heat requirements of a building, which starts with a heat loss calculation performed in the way set out in the IHVE "Guide". Such a calculation produces a heat which is the net amount of heat required necessary to maintain the design conditions—a required internal temperature against specified external temperature and ventilation rate.

Since off-peak operation involves a supply not being continuously available, the installed floor-warming load must be in excess of net heat requirements, in order to provide, in the hours available, the thermal energy required under design conditions of 24 hours' duration. Yet net heat requirements have been installed, and appear to provide satisfactory conditions, in large buildings at least.

This seeming paradox (which was also discussed in our 25 February issue) is accounted for by Mr Shepherd on two grounds. He suggests, first, that night-time ventilation rates (when the building is unoccupied) are considerably less than obtain during the day, so that installations based only on the greater day-time, or "occupied" rate of air change will automatically incorporate a bonus of load. Secondly, and perhaps of more significance, he indicates graphically that the coefficient of thermal transmittance (U-value) of a concrete floor of large area laid direct on the ground may, in fact, be only one-tenth of that value (0·2) given in the IHVE "Guide". For a concrete floor exposed on all four edges, the coefficient varies from



1, J. I. Bernard and T. E. Daniel receive D. Donnan (NWEB). 2, a NEEB group: R. Keenlyside, H. Ainsworth, W. Gill, R. Robson, 3, G. W. E. Gray and L. H.Tearle of LEB chat with B. A. Baker (Jersey). 4, J. P. Montgomery (MEB), L. A. Lee (EMEB), A. J. Milne (MEB)

Design method for off-peak floor-warming.

Parameter	Method of calculation
1. Structural heat loss, H_s (B.Th.U./h).	As recommended in IHVE Guide.
2. Day-time ventilation heat loss, H_{vd} (B.Th.U./h).	$C.n.V(t_a-t_o)$.
3. Night-time ventilation heat loss, H_{vn} (B.Th.U./h).	$C.0{\cdot}5\ V\ (t_a-t_o)$.
4. Total heat requirement from floor, H_u (B.Th.U./h).	$[24\ H_s+h_w\ H_{vd}+(24-h_w)\ H_{vn}]\div 24$.
5. Ave. max. floor surface temperature, t_s (°F).	$t_a-S+(H_u/1{\cdot}7\ A_h)$.
6. Ave. max. mean temperature at cable level, t_w (°F).	$t_s+(H_uR_u/A_h)$.
7. Downward heat loss, H_d (B.Th.U./h):	
(a) solid gound floors	$A_h\ U_d\ (t_w-t_o)$.
(b) suspended floors.	$A_h(t_w-t)/(R_d+0{\cdot}85)$.
8. Installed load, H (kW).	$24(H_u+H_d)/3410h_t$.

C=specific heat of 1 cu ft of air (0·02).
n=no. of air changes per hr (from IHVE Guide recommendations).
V=volume of space to heated (cu ft).
t_a=required internal air temperature (°F).
t_o=design external air temperature (°F).
h_w=period of occupation per day (hrs).
A_h=floor area available for heating (sq ft).
$S=\frac{1}{2}\ [0{\cdot}6\ U_m\ (t_a-t_o)]$ (°F).
U_m=mean u-factor, obtained by dividing net structural heat requirement by total unheated area.
R_u=thermal resistance of floor *structure* above cable plane (excludes surface resistance).
U_d=downward heat transmittance coefficient (from graph).
t=temperature of space below (°F).
R_d=resistance of floor *structure* below cable plane (surface resistance represented by factor 0·85).
h_t=hours per day of supply available.

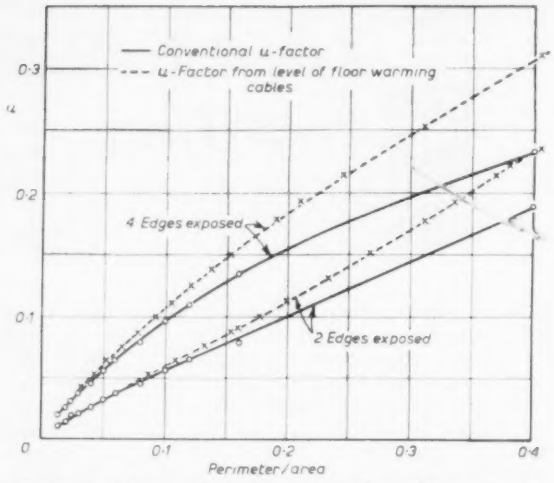
0·258, for a floor 10ft square to 0·02, for a floor 500ft by 200ft; it can even drop to 0·011 for a floor exposed on only two edges. Hence, a net heat requirement calculated with a floor U-value of 0·2 will be too large and will include a bonus of load.

The design method suggested by Mr Shepherd, is that of the EDA Design Panel, pending the evolution of a standard design method from studies being sponsored by the Heating and Ventilating Research Association. The steps in the method are set out in the accompanying table. There is one major assumption; that the night-time ventilation rate is a constant of half an air change per hour, irrespective of the day-time rate. The limiting factor is, of course, the maximum temperature of 77°F to 80°F for the floor, which limits the rate of heat emission from the floor.

His comments on the precautions to be observed in installing thermal insulation, laying screed and providing control devices, are generally familiar to most engineers by now; there is also a reminder to make adequate provision for structural movement between adjacent structural slabs and concrete beams. He also covers a less-publicised aspect of designers' work: determining cable layout and preparing working drawings for the site electrician.

Discussion

In opening the discussion on MR SHEPHERD'S paper, J. W. MOULE (SSEB) rejected any implication that the supply industry had made extravagant claims for floor-warming. He suggested that the "paradox" may be explained by the fact that running costs were related to average daily temperatures, and not the minimum against which design was based; he also argued that there was no need to make allowance for intermittent supply availability. Also concerned with the "paradox," W. G. NOTTAGE



Variation of the U-value of bare solid concrete floors with area, based on values quoted in IHVE Guide. Resistance of floor finish not included.

(LEB) suggested that it might be explained by the way in which floor-warming created comfort; he also suggested that where mechanical ventilation was installed, some of the heating load might have to be applied to warming the air inlet to at least 80°F.

MR E. M. ACKERY (EDA) stressed the importance of using a uniform design procedure throughout the industry; non-uniformity would provide another opening for criticism. Commenting on draughts from windows, A. W. ALLWOOD (SWEB) suggested that window contractors should themselves fit the windows. MR R. A. BLAKE (LEB) suggested that ill-effects of downward heat loss might be ameliorated by arranging dwellings in multi-storey blocks as two-storey maisonnettes, with bedrooms below living rooms. H. E. SMITH (SSEB) advised that a period of four weeks for every inch of overall concrete could be adopted for curing and drying out although it was wiser to treat each case on its merits.

Returning to downward heat loss in multi-storey blocks, A. F. HARDCASTLE said that the simplest way of dealing with the problem was to treat the building as a single unit, with landlord responsibility for the heating. Such a scheme was now operating successfully at Reading, with one regulator controlling the whole of the building, local thermostats operated mainly as safety devices. R. M. LANG (SWEB) suggested that the night-time saving in ventilation loss might be offset by increased radiation losses in cloudless weather conditions; he also asked how rigorously it was necessary to adhere to IEE Reg. 314. E. H. HOOD (MEB) suggested there was need for closer study of wood block floor finishes.

Profitable Selling

If Mr. Shepherd's paper presented area board commercial officers in the guise of heating engineers, the final paper could be taken as showing them as sales accountants. Its author, J. P. Montgomery, M.S.M.A., M.I.A.M.A., D.A.A.(MEB), was concerned with increasing the profitability of area board retailing. His starting point was that financial aspects of boards' trading have been subjected to unfavourable criticism, in respect of low profits and allegedly unbusinesslike practices. The surplus of £15 million, earned in the trading turnover since vesting day of £385 million, represented less than 4% return. A worthwhile surplus to aim for would be 8%, with a stock turnround of four to five times per annum; overall gross profit margin should be about 24%. There was now no question of electrical development and trading profits being incompatible, and if boards were to derive an adequate financial return, planned and co-ordinated selling was essential.

One of the first requirements in planning for profit is successful marketing, which relies on an efficient process of acquiring goods from suppliers, stocking them, presenting them to the public and selling them. Successful marketing means not only determining the best, most popular and most profitable lines and estimating the quantities in which they can be sold, but also consideration of the financial investment involved in building up stock.

Economic stocking requires accurate sales forecasting. This is not easy and involves analysis of past sales, potential market, general trading and economic conditions, impact of new products and possibilities from changes in organisation. From the forecast, a month-by-month sales budget should then be drawn up for each coming year. The sales forecast also provides the starting point for the cash budget which is an assessment of the cost of sales and of the profit they will bring. The probable value of gross profit can be arrived at from analysing the "mixture" of sales which make up the estimated turnover, and the known discount margins which individual components of the "mixture" carry. The actual profit is then estimated by deducting total costs from gross profit.

The final procedure is control of the budget, which is achieved by comparing, on a month-by-month basis, actual with estimated sales, actual with estimated costs, and actual with estimated surplus. If the right information is being reported back, a control schedule provides a moving picture all the time of the way performance is going and how costs and profits are working out. More important, it gives warning of the need to do something when things are going wrong, so that corrective action can be taken early enough to achieve results.

Efficient organisation, however, is only half the battle; success ultimately will rest with the personnel. Adequate numbers of trained, and temperamentally suitable, sales staff is an obvious requirement, but they must have inspiration and leadership. Teamwork is essential. There may well be need for senior sales development assistants in fair-sized districts to take over complete control and direction of the sales force. Some incentive will also be worthwhile, if not monetary, then much more definite channels for promotion.

Discussion

Opening the discussion, E. BATES (NEEB) stressed that service to consumers was an integral part of the supply industry's activities. He argued that the whole objective of these activities was load building but he also commented that boards could do more to increase sales of washers and refrigerators. M. R. COWAN (NWEB) said that service centres should be in a position to say they are making a good profit, which, after all, is the purpose of providing showrooms.

C. W. SMITH (SEEB) advocated the general adoption of budgetary control; H. B. ATKINSON (SEEB), however, said that boards were hamstrung by the accounting and auditing mentality and that the paper work involved was out of proportion to the results achieved. P. S. GRANT (SWEB) commented on the difficulty of accepting arbitary allocations. A call for examining the possibilities of cash discount trading was made by H. AINSWORTH (NEEB), who also said that a cash bonus for sales should be made to staff, on the lines of the gas industry's system.

C. J. AGG (SWEB) questioned the accuracy of forecasting under all conditions, such as this year's demand for refrigerators; L. J. DOWNES (YEB) wondered whether the author's basis for sales staffing would not be over optimistic for large service centres, and whether outside salesmen were to devote all their time to selling. R. J. HONNIBALL (EEB) said that the supply industry must create demand for electricity and that it was the only medium for impartial co-ordinated selling; he suggested there was need for two stock budgets, one for the commercial manager, the other for financial control. F. T. GARDNER (EMEB) called for better rewards for service centre assistants; L. W. G. HETHERINGTON (LEB) stressed the importance of keeping staff informed of the board's policies.

Selling Cookers

The main discussion on the earlier papers was that on the problem of promoting cooker sales. It was initiated by A. O. JOHNSON (NWEB), who said the main problem was selling to lower income groups, particularly local council tenants where the authority provided the cooker and freedom of choice. Only slum clearance schemes provided opportunity to reach prospective tenants by canvassing and direct mailing, unless Councils provided lists of tenants. Although local paper and poster advertising was a suitable medium, television was worth re-consideration, and cinema advertising for reaching teenagers. It was more profitable, however, to try to remove the prejudices against electric cooking held by teenagers' mothers. As these were often based on experience of users of obsolete models, it would perhaps be simpler to give away cookers over 20 years old, with the aim of replacing such cookers with up to date models a trade-in allowance of £2 would also stimulate replacements. G. V. HARRAP (SEEB) stressed the importance of keeping cookers in school domestic science centres up to date; S. MAWSON (LEB) stressed the need to ensure sales staffs to be fully trained and informed; he also wondered if the author was suggesting that outside representatives should become exclusively appliance salesmen.

Commenting on repair difficulties, D. MACDOUGALL (SSEB) regretted the large variety of spare parts, there were 31 different makes of hot plate before the 7 in. family type was introduced. W. G. NOTTAGE (LEB) spoke of the usefulness of the *Good Housekeeping* recipe book, whilst both R. J. HONNIBALL (EEB) and W. WALLWORK (MANWEB) mentioned the value of outside displays and display vans. MISS D. TAYLOR had the last word, endorsing an earlier comment that male selling staffs should know how to cook; they might then appreciate some of the drawbacks which had yet to be overcome.

1, D. B. Irving (Chairman, LEB) with H. V. Pugh (Chairman, EEB) at exhibition. 2, Miss M. Gilbert (EDA) examining a fridge with W. G. Guscott (SWEB). 3, W. R. Gooud and E. J. Dench (LEB) with A. L. Bass (Falco). 4, L. C. Parker (SEEB), J. I. Bernard, C. S. B. Slight and J. Moody (SEEB)

OVERSEAS NEWS

from our correspondents abroad

CANADA

Objection to Order

Although C. A. Parsons and Co. have submitted the lowest tender ($1,544,915) for a steam turbine-generator for Edmonton, Alberta, the latter Council have held up award of the contract for the time being. The second lowest tenderer, Canadian Westinghouse Co., whose price was $1,574,000, has warned the City Council that Parsons' low tender could be subject to some $625,000 in import and "dump" duties. The Council referred the matter back to its finance committee which had recommended acceptance of Parsons' tender, after studying a letter from Canadian Westinghouse. In this the company's vice-president and general manager, Mr J. A. Campanaro, stated that the federal Government's agreement with the UK to permit steam turbines duty free "becomes inoperative as soon as units of this type are ruled of a 'class or kind' manufactured in Canada." He assures the Council that an application requesting a "class or kind" ruling which bears every promise of success, will be made before the end of 1960. Thus the City of Edmonton could be exposed to an import duty of about $225,000. He also points out that when an item is ruled "class or kind made in Canada" it is subject to dumping laws, which would mean a penalty of the difference between the dump price and the fair market value in the country of origin, which could be some $400,000 in this case, he states.

INDIA

Loco Order

The English Electric Co. have received an order from the Indian Railways Board covering the supply of ten sets of electrical equipment for 3,600 h.p. 1,500 V d.c. electric locomotives, the mechanical parts of which will be built in the Indian Railway Workshops of Chittaranjan. They will be the first electric locomotives to be built in India. The design of the locomotive is based on those supplied by English Electric for use on the Central Railway in 1954/55 which have been in continual successful service operating between Bombay-Poona (119 miles) and Igatpuri (85 miles). The original locomotives are equipped with regenerative braking and haul 560 ton passenger trains at 68 m.p.h. at level track. When operating in freight services the locomotives are required to work 2,000 ton trains against a 1 in 100 gradient at 30 m.p.h. The electric equipment for the new locomotives will be so designed that should there be a failure in the control equipment, operation is ensured by cutting out half of the control gear and operating with the other half in circuit only. The factory at Chittaranjan was planned and built primarily as a steam locomotive works after world war II in association with British locomotive manufacturers. Amongst them Vulcan Foundry, now a member of the English Electric group, played a leading part. Although the production of steam locomotives will continue there for the time being, Chittaranjan is now faced with the same conversion problem which British firms such as Vulcan Foundry and Robert Stephenson and Hawthorns have had to solve in the past few years—the change-over from steam to newer forms of rail transport. The present order will assist Chittaranjan in this task.

Bhakra Restoration

Major equipment at Bhakra hydro-electric project, which was feared to have been seriously damaged in the inundation accident last August, has now been pronounced fit for service. The final loss estimates are therefore expected to be much lower than the Rs1,550,000 earlier suggested. After vigorous testing with imported instruments, three stators, one rotor and five governors, which had been submerged for days, will be put into commission according to schedule, the authorities have stated. The superintending engineer in charge of the left bank power house, Mr Gulab Singh, announced that the 90,000 kW unit No. 1 would now be switched on some time in October or November as planned earlier. Unit Nos. 2, 3, 4 and 5 would be commissioned later in that order. Two stators and one rotor, which were in position at the time of the accident, were subjected to "slow baking" by passing a low voltage current through them for several weeks to dry them. Afterwards the coils were subjected to 34 kV tests. The coils of the third stator, which was in the power house, but had not been erected at the time, were removed to the workshop and dried and tested separately. All the five governors—two which had been erected and three which were still in their cases when the Sutlej waters invaded the power house within an hour of the accident—were completely dismantled, dried and tested at the workshop.

Soviet Aid?

The Uttar Pradesh Government is hoping to obtain Soviet aid to help push through its plan to set up a thermal plant near the Singrauli coalfields in Mirzapur district. Russian experts are expected to visit the site soon. The plan is to erect a 450 MW plant which will utilise the newly discovered coal deposits at Singrauli and provide cheap power in south east UP. The State Government is giving the Singrauli plant highest priority for the third Plan. If possible, preliminary work will begin in the current year.

PAKISTAN

Railway Electrification

Plans for railway electrification in West Pakistan are now being scrutinised by the authorities. So far, the British experts engaged by the Pakistan Railways have submitted plans after surveying and examining the track position. Some Japanese experts, who recently visited Pakistan in this connection, will submit their report within this month. A similar invitation has been extended to German technicians.

CEYLON

Problem of Change

There is as yet no indication that the Government of Ceylon is soon to implement the recommendation of Mr J. G. Park, that control of generation and distribution of electric power should be transferred to a Central Electricity Board. Such a change was made a condition of the release of funds by the International Bank for Reconstruction and Development for stage IIB of the Laxapana hydro-electric project. The Government have indeed, drawn up a Bill to provide for the transfer of power operations, but in view of the strong opposition by the municipal authorities, to which we have already referred, it is by no means certain that the Bill will receive final approval. Until that is done, the International Bank refuse to advance their loan. On to this scene have come representatives of Western Germany who have indicated that assistance could be provided from that country if the Bank loan fails to materialise in time—the proviso being, of course, that Western German contractors and equipment would be used.

SARAWAK

Progress Under Difficulties

Without any recognised hydro sources within a reasonable distance of the major centres, Sarawak has had to develop its comparatively small power supplies from thermal stations. Even now, seven years after the formation of the government-owned Sarawak Electricity Supply Co., which has taken over the undertakings formerly operated by United Engineers Ltd., development can only be undertaken where it is economical to do so and the task is obviously a difficult one. In the year ended, 30 June last, units sold to the 11,010 consumers totalled 12·4 millions, an increase of 10% over the previous year. The Government has laid down that the company's undertakings shall be operated in a business-like manner, the idea being to pay a dividend of not more than 5%—but no dividend was paid in the year under review. There are 11 power stations at various points of the island, the largest being Sungei Priok which was commissioned last August and has three English Electric 1,350 kW heavy fuel generating sets, with provision for the inclusion of three 400 kW sets to be transferred from the Kuching station, which has been closed. Consulting engineers for the Sungei Priok station were, Preece, Cardew and Rider. Investigations into the use of free-piston gasifiers for any new sets have been instituted, and, dependent on results of similar plant at Singapore, will be considered when further generating plant is installed. To increase domestic consumption, the company is considering expanding the hire scheme to include proven branded electrical appliances to augment their standard range of cookers, ceiling fans and water heaters. There is also an assisted wiring scheme. The restricting factor in the electrification of smaller settlements in Sarawak is their inaccessibility, their isolation, and the small numbers of inhabitants. Industrialisation will also be restricted until cheap sources of power are developed. To this end, a hydro-electric survey is being considered, and it is hoped that low-head stations may be feasible.

AUSTRALIA

Plant for Morwell

The State Electricity Commission of Victoria has placed a £850,000 order for a new 60 MW steam turbo-generator to be installed at Morwell power station before the end of 1963. The order goes to ASEA Electric (Australia) Pty Ltd., the Australian subsidiary of the Swedish manufacturers. Main components of the set will be made in Sweden by De Laval, Ljungstrom Turbine Co., but Mr Reid, the Minister for Electrical Undertakings, has stated that more than £283,000 of the contract price would be spent in Australia. The machine will be the fifth and final set to be installed at Morwell.

NEW ZEALAND

Experimental Cable Lifted

The coastal vessel *Pateke* has lifted an experimental power cable from the bed of Cook Strait, New Zealand. The cable will be sent to its manufacturers in Manchester who will report to the Government. This cable was laid about two years ago as part of investigations to test its qualities for the proposed connection of the North and South Island power systems across the Strait. The Minister of Electricity, Mr Watt, said the cable was lifted without trouble and electricity department officers would make a superficial inspection of the cable before it is returned to England for test and examination. Another half-mile of cable, of lighter construction, remains on the Strait bed, laid by the manufacturers for their own purposes. This would be lifted and sent to Britain as soon as possible. The Minister said that the report on the Cook Strait cable project by the consultants would be discussed by the power planning committee at its meeting this month.

Hydro Investigation

Representatives of two firms of American consulting engineers—the Bechtel Corporation of San Francisco, and Jacobs Associates of the same city—have arrived in Southland, New Zealand, to prepare a preliminary report on development from Lake Manapouri. Australian Consolidated Zinc Pty. Ltd., under a agreement with the New Zealand Government, are investigating the power potential of Lakes Manapouri and Te Anau with the object of using them for a £100 million aluminium industry in Southland and have called in these experts.

The company has been given two years in which to complete investigations. A site at Deep Cove, in Doubtful Sound is at present considered the best for a hydro station for the aluminium works, which will be built between Invercargill and Bluff. If the results of the geological work and reports of the consulting engineers from the USA are favourable, Consolidated Zinc will go ahead with further detailed work as agreed upon with the New Zealand Government recently.

HONG KONG

Change Recommended

The compulsory purchase of the two private electricity undertakings which at present supply Hong Kong colony, and their replacement by an independent public authority, is recommended by the commission set up by the Hong Kong Government to inquire into the colony's electricity supply organisation. This was stated by the Secretary of State for the Colonies in answer to a question in the House of Commons last week. The members of the commission, which took evidence in Hong Kong last year, were Mr J. Mould, formerly chairman of the East Midlands Electricity Board, Mr C. J. M. Bennett, F.C.A., of London, and Mr D. J. Ruttonjee, O.B.E. The two undertakings now serving the area are the Hong Kong Electric Co. Ltd. and the China Light and Power Co.

An interior view of the recently completed T.I. power station of the Snowy Mountains Hydro-Electric Authority, during visits by delegates to the Twelfth International Congress on Scientific Management, held in Australia from 22 Feb. to 4 March. It is reported that the size of the scheme impressed even a West German delegate! T.I. is the second power station of the Snowy Scheme to go into operation. There are four 110,500 h.p. Francis type turbines, supplied by the English Electric Co. Ltd., driving 80 MW ASEA generators. The Snowy Scheme is a vast multi-purpose plan aimed to divert mountain rivers that flow eastward into the higher rainfall areas of the coastal belt, so that they will flow west through trans-mountain tunnels to the rivers which feed the dry farmlands of the Murray Basin. In addition to providing an extra two million acre-feet of water annually for irrigation, the scheme includes a series of generating stations having an ultimate capacity of 3,010 MW

Personalities *in the industry*

Mr D. Bates

Mr D. A. Wenglaryk

Mr E. A. Seeley

Mr E. F. D. Webb

Mr C. W. Poole

Measuring Instruments (Pullin) Ltd. have made a number of new appointments. **Mr D. Bates,** assistant to the chief development engineer, now becomes production manager, in succession to Mr C. A. P. Cannon, whose appointment as assistant to the managing director was announced recently. Mr Bates has wide knowledge of all branches of the instrument industry, and before joining MIP in August last year he was for ten years with Sifam Electrical Instrument Co. at Torquay; he has also had experience of the industry in Sarawak and North Borneo, as well as with a number of leading firms in this country. **Mr D. A. Wenglaryk,** who has been works foreman for the past seven years, is now appointed chief inspector, responsible to the managing director. His considerable practical experience of the industry has been gained in the calibration, development and standardising and inspection departments, and he has also attended specialised instrument courses from time to time. The successor to Mr Wenglaryk is **Mr E. A. Seeley** who has been with MIP for ten years and as head of the standardising department has been responsible for the calibration of all precision instruments. As works foreman he will be responsible to the production manager.

Previously assistant chief designer with Cannon Industries Ltd., **Mr W. J. Wyers,** F.R.S.A., GRAD.I.PROD.E., has been appointed products assistant chief designer to the Research and Development Department of Rubery Owen and Co. Ltd., the parent company of the Owen organisation. He will be responsible for the complete design, prototype build and test and the production of a number of the group products.

Mr George Henderson, A.H-W.C., A.M.I.E.E., and **Dr C. W. Marshall,** B.SC., M.I.E.E., are to retire from the board of directors of Bruce Peebles and Co. Ltd. on 1 April, but their services remain available to the company in a consultative capacity. Mr Henderson only retired last September after 57 years as a full-time member of the firm's staff. Mr Marshall was divisional controller of the South West Scotland Division of the BEA from 1951 to 1955.

Recently returned from America, where he has been investigating automatic process control methods, **Mr E. F. D. Webb,** B.SC.(ENG.), A.C.G.I., has been appointed engineering manager of Hagan Controls Ltd. Mr Webb was chief engineer of Fuel Firing Ltd. from 1953-1958 and was previously technical director of Ipscol Ltd. where he designed control systems for the combustion control and process industries. After leaving London University in 1935 he joined Merz and McLellan, the consulting engineers, where he was responsible for commissioning and installing power transmission and generating plant.

The Eastern Electricity Board have appointed **Mr C. W. Poole,** at present senior assistant commercial engineer in the Fens Sub-Area, to be the commercial officer in that sub-area in the place of Mr R. B. Richardson who now occupies a similar position at Bedford. (*ESH, page 102.) Born at Haverhill in 1903 Mr Poole started with C. C. Pudney and Co., electrical engineers, at Bury St. Edmunds, in 1918. He remained with this company until the early thirties when he joined the East Anglian Electric Supply Co. Ltd. as a sales assistant and wiring foreman, being responsible to the resident manager for all the commercial activities. In 1932 he joined the Hunstanton branch of the company where he had control of a much larger area and number of staff. In 1933 he was the senior assistant to the sales manager of the East Anglian company and in 1934 he became the sales engineer in the Norfolk area. When the East Anglian Supply company assumed control of the Beds, Cambs and Hunts Co., Mr Poole became their sales engineer, being charged with commercial development and load building. His work also included the supervision of 10 branch offices and showrooms. In Jan., 1939, he was appointed the sales manager of the Cambridge Electric Supply Co. and at the end of the war he returned to St. Neots as sales engineer for the B. C. and H. concern, with special attention to rural development. In 1948 Mr Poole became the senior assistant commercial engineer in the Fens Sub-Area.

Sir Samuel H. Brown has been appointed a director of the British Columbia Power Corporation and of British Columbia Electric Co. in place of the late Mr E. R. Crammond. Sir Samuel is chairman of Sangamo Weston Ltd.

For the past nine years general manager of the Wells factory of EMI Electronics Ltd., **Mr W. Pigdon** is leaving shortly to take up a new position as executive vice-president of EMI-Cossor Electronics Ltd., in Halifax, Nova Scotia. Mr Pigdon's duties at Wells are being taken over by **Mr E. Bagley** as chief executive responsible to Mr P. A. Allaway, deputy managing director of EMI Electronics. Mr Bagley has been assistant to the engineering director in charge of Ministry work at Hayes for a number of years. He has been responsible for liaison work between Hayes and Wells and is very familiar with the work being undertaken there.

General manager of the Port-of-Spain Corporation Electricity Board, **Mr E. G. Robinson** is on retirement leave. **Mr R. E. K. Inniss,** A.M.I.E.E., is now acting general manager and will succeed to the major office.

Formerly assistant secretary, **Mr N. D. Mathie** has been promoted to secretary of Johnson and Phillips Ltd. in succession to **Mr A. B. Adam,** F.C.A., who has retired.

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* *Denotes revision to the "Electricity Supply Handbook, 1959."*

General manager of the Toronto Hydro System, **Mr H. Hyde,** has been elected president of the Association of Municipal Electricity Utilities (of Ontario).

Newly appointed manager, Southern district, AEI-Hotpoint Ltd., is **Mr V. Satal** who joined the company a year ago from Ever-Ready Razor Products, where he was export manager. Last July he was appointed assistant to the Southern Division sales manager, and in January became sales personnel officer.

Three top men in the management of the Prestcold sales organisation have been named to take up important new positions in this Division of Pressed Steel Co. They are **Mr C. V. Jones,** who is appointed as marketing manager—commercial refrigeration products for the UK; **Mr M. S. Ware,** B.SC. ENG.(HONS.), A.M.I.E.E., M.I.S.M.A., who will become general manager—London region and **Mr J. Parker,** deputy general manager—London region. Mr Parker was previously London domestic sales manager to the company. Under this new arrangement, Mr Ware will be responsible for the complete operation of all activities in the London region. Mr Jones has been with Prestcold for eight years, during which he has held the position of manager at the company's branches at Kent and London. He will now be responsible for sales of all the firm's commercial refrigeration.

Sir Willis Jackson, the IEE president, is among those upon whom an honorary degree of Doctor of Laws of Belfast University will be conferred in July.

Formerly with AEI Lamp and Lighting Co. Ltd., **Mr C. Perry** has, this week, joined Philips Electrical Co. as a street lighting engineer with the south-east region.

Mr M. McGrouther, M.A., LL.B., has been appointed secretary of the Glasgow area of the South of Scotland Electricity Board in succession to **Mr J. Cairns,** who is retiring. Mr McGrouther has been secretary of the Board's Stirling area since 1957 and was previously in the county clerk's office of Stirling County Council (*ESH, pages 160, 162).

Formerly north western area representative for Chilton Electric Products Ltd., **Mr F. Holland** has been promoted to domestic sales manager for the company, based at the head office at Hungerford. We understand that expansion in this sphere is planned with additional small appliances being marketed. His successor as north western area representative is **Mr I. B. Boyd,** who was previously sales engineer for Edward Holme and Co. (1931) Ltd.

Southern Areas Electric Corporation Ltd. announce that **Mr J. Softley** has been appointed general manager of their subsidiary, Designs and Installations Ltd. He was formerly on the executive staff of Ross Courtney Ltd., another member of the group.

Mr A. E. Coupe has been appointed Northern area technical representative for Martindale Electric Co. Ltd., covering Lancashire and Cheshire.

At the end of this month **Mr S. Blewitt,** a director of John Thompson Castings Co. Ltd. and deputy director and chief cashier of John Thompson (Wolverhampton) Ltd. retires after 51 years' service with the group. His successor as chief cashier is **Mr H. J. Randall** who has worked under Mr Blewitt for 22 years.

In the reorganisation of the Morphy-Richards group, to which we referred last week, **Mr W. Roxburgh,** who joined the board of the parent company last year, continues as managing director of Morphy-Richards (Astral) Ltd. and two new appointments have been made. **Mr D. A. Reader,** who joined the group last year as marketing manager, becomes a director and general manager of Morphy-Richards (Sales and Service) Ltd., and **Mr H. W. A. Griffiths** is to join the concern after Easter as director and general manager of Morphy-Richards (Cray) Ltd. The opportunity has also been taken to promote to the boards of the subsidiary companies a number of their senior executives, the names of whom are shortly expected to be announced.

Sir Hamish D. MacLaren, K.B.E., C.B., D.F.C., LL.D., B.SC.(ENG.), M.I.E.E., Director of Electrical Engineering Division, Admiralty, is to retire from that position in Oct. next.

From Crompton Parkinson Ltd. we learn of two new appointments. **Mr Brian Jubb,** B.SC.(ENG.) HONS., A.M.I.MECH.E., A.M.I.E.E., has now been designated sales manager, Guiseley A.C. Motors in the Industrial Motor and Lighting Division, and **Mr C. E. Hucker** has become sales manager, Fractional H.P. Motors, in that same division. Mr Jubb joined the company in 1931 and worked until 1938 as a sales engineer in the Birmingham and Manchester areas. He served during the war in the Indian Army, achieving the rank of Lt-Col. In 1949 he rejoined Crompton Parkinson and has been, in succession, sales manager, instruments, and sales manager, fractional h.p. motors. Mr Hucker has been manager, for plant products, of the company's Cardiff branch, since Oct., 1958, having joined Crompton Parkinson in 1948 as a sales engineer in the Bristol area. During the war, after enlisting in the Royal Armoured Corps in 1939, Mr Hucker joined R.E.M.E. at its inception in 1943 and served with them until 1946, with the rank of captain.

Mr F. W. Hodges has been appointed to the board of Warsop Power Tools Ltd. as managing director.

For 21 years Superintendent of Barrow power station, North West Merseyside and North Wales Region, C.E.G.B., **Mr L. Hargreaves** was the recipient of a presentation by Sir Christopher Hinton to mark his retirement. (*ESH, page 68).

Mr J. R. Cotterill, J.P., M.I.E.E., M.I.MECH.E., M.I.MAR.E., has been appointed manager of the Outside Services Department at the Witton Works of the General Electric Co. This is a new department formed to co-ordinate erection, commissioning and post-commissioning service of electrical plant.

OBITUARY

Mr F. G. Chitty, sales director of Electrix Ltd., died on 5 March, aged 63. He joined that company in 1935 and became a director three years later.

Sir Edward Crowe, K.C.M.G., formerly a director of W. T. Henley's Telegraph Works Co., English Electric Co. Ltd. and Marconi's Wireless Telegraph Co., died on 8 March, aged 82.

Mr Arthur Anderson, founder of the Middlesbrough business of A. Anderson and Son (Electrical Engineers) Ltd., died on 6 March, aged 76. He gained early experience with Richardsons, Westgarth and Co. Ltd. and later became electrical engineer at Sir Raylton Dixon's Shipyard in Middlesbrough, prior to forming his own business in 1927. The firm was converted to a limited company in 1935.

Mr George Ward, vice-president of Thomas W. Ward Ltd. since 1954, has died, aged 76.

Dr H. Stansfield, D.SC., A.M.I.D.E., lately Professor of Physics and Electrical Engineering in Southampton University College, died on 14 March.

Mr F. C. Heayberd, governing director of transformer and battery charger firm of F. C. Heayberd and Co. Ltd., died on 10 March, aged 73. He founded the business in 1924.

Mr V. Satal

Mr F. Holland

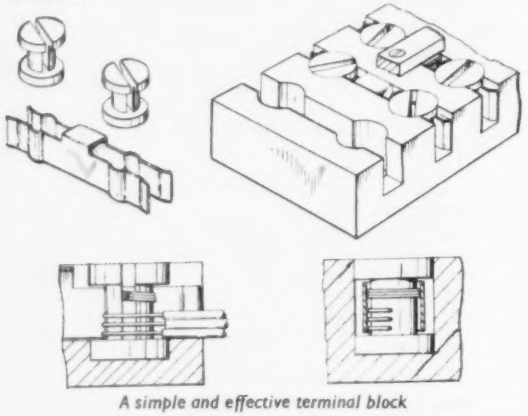
Mr I. B. Boyd

PROGRESS IN PATENTS

SELECTED SPECIFICATIONS

Terminal Block

Few electrical components have invited such a variety of idea and design as the common terminal block. Some are complex, ingenious but commercially impracticable; others are simple, effective and easy to produce. Among the latter one may include a device described in specification 830,019, in the name of S. H. and C. G. Robin, of Laleham, Middlesex, which comprises only three components, an insulating moulding with retaining bar, a metal pressing and a slotted and turned metal member. The simplicity is such that it lends itself to the clearest exposition in the drawings accompanying the specification which are reproduced here without their numerical references.



A simple and effective terminal block

The device is essentially for the class of termination employing a bared conductor end without tag and will probably be more suited to small gauge single core wires of lighter current-carrying capacity.

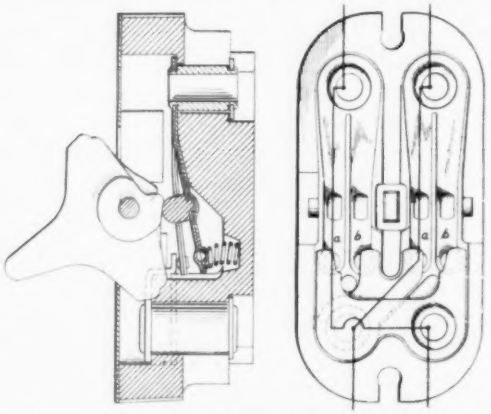
Linear Electric Motor

The conventional electric motor provides rotary movement of its shaft which, should the occasion demand linear motion, can be converted by mechanical means. Such motion is frequently called for in machine tools and linear electric motors, comprising an outer magnetic field winding through which the armature moves axially, have been developed in which the axial movement is produced by coupling windings on its length sequentially to the supply source through a linear or rotary commutator actuated by the movement of the armature.

A linear motor of this type in which two or more speeds of travel are possible is described in specification 830,172, credited to the British Thomson-Houston Co. (now AEI (Rugby) Ltd.) of Crown House, W.C.2. The armature comprises a number of annular windings accommodated in circumferential grooves around an iron core mounted on and integral with the operating shaft. Connections from the windings are taken in sequence to segments of two adjacent linear or rotary commutators each winding bridging the gap between one segment and the adjacent or next-to-adjacent segment. Brushes suitably disposed along or around one commutator provide current to the windings in series between the two brush positions, the commutators being so linked with the armature shaft as to transfer excitation current from windings immediately within the influence of the stationary field to adjacent windings next due to enter it. Groups of contact pieces selectively linking the two commutators can provide a choice of two or more series or series-parallel connections which will enable different speeds of travel to be obtained.

Intermediate Electric Switch

An up-to-date concept of the intermediate reversing switch for three or more position lighting control is described in specification 829,995 in the name of M.K. Electric Ltd., of Edmonton, London N.18. The base of insulating material supports two adjacent input terminals each forming the anchor point of a pair of resilient arms, which we shall call *a* and *b*, terminating in contacts and, at the opposing end, two output terminals each forming the anchor point of two fixed contacts so arranged that one contact from each output terminal is immediately over one resilient arm contact from each of the opposite input terminals. An insulated dolly supported on the bridge piece of the base carries two cams



Intermediate switch for multi-position lighting control

engaging with the resilient arms in such manner that, in one position, contact with the *a* arms and fixed terminals is broken, leaving the *b* contacts closed to conduct the current directly across the switch while, in the other position, the *b* contacts are opened and the *a* contacts closed to conduct the current diagonally across the switch. Normal closing and contact pressure is applied by the resilient arms reinforced by coil springs retained in housings in the base, these also serving to give positive action to the movement of the dolly towards each position.

Reproduced by permission of the Controller of H.M. Stationery Office. Copies of specifications may be obtained from the Patent Office (Sales Branch), 25 Southampton Bldgs, W.C.2. Price 3s 6d.

The Lower Rating Limit for High Voltage Motors

DESIGN FACTORS LIMIT MOVE FROM MEDIUM VOLTAGE

by "Motor Designer"

MANY industrial installations use both low-voltage and high-voltage distribution systems, and the problem of selecting the optimum voltage for a given motor is one which many works engineers may have to deal with from time to time. The problem may arise in various ways. It may be necessary simply to decide whether a given projected motor shall be supplied from an existing low-voltage distribution system or from an also existing 3·3 kV or 6·6 kV system. Or it may be necessary, for example, to decide whether the principal internal distribution system for, say, a pumping station, or a compressor house, shall be at a standard low voltage (such as 415V), or at 3·3 kV or 6·6 kV, with a transformer for any smaller low-voltage motors and for various other services.

It is clear, from the many queries received by motor manufacturers, that average users (even those reasonally well-informed in their own spheres and well-qualified electrically) have little or no appreciation of the very real problems which arise if an attempt is made to design and build a motor for an unsuitably high voltage. It is the object of this article to explain briefly to the non-specialist some of the problems affecting the design and manufacture of relatively small high-voltage motors.

There are two important factors which make it impossible to obtain anything like the normal low-voltage output from a given frame-size at higher voltages. These are:

(a) the much thicker slot insulation necessary, and

(b) the flux loading reduction necessary on account of the almost enforced use of open slots.

On closer examination it will be found that these factors not only result in a progressive worsening of the high-voltage/low-voltage output ratio as the required output is reduced; they also dictate, for a given voltage, speed, enclosure, and temperature rise, an effective minimum output below which no satisfactory design is possible.

Design considerations

Some manufacturers employ, at least for 3·3 kV motors, a type of multi-turn winding which is inserted turn by turn into a semi-enclosed slot with an offset opening, the principal insulation to earth being a "soft" slot liner. Most designers, however, incline to the view that the only really satisfactory winding is one in which the coils can be completely formed and insulated before their insertion into the slots; such a winding is invariably of the multi-turn two-layer diamond lap type, the principal insulation comprising a suitable thickness of hot-wrapped bonded micanite. In any one slot there are two separate coil-sides, often belonging to different phases, and a completely open slot is essential.

With a completely open slot, however, the effective air gap area is considerably reduced by comparison with the semi-enclosed slot normally used for low-voltage windings. In an induction motor, the magnetising current is one of the more important design considerations, and in the interests of a reasonably high running power factor the enforced use of an open slot imposes a severe limit on the permissible mean flux density in the air gap. Furthermore, the increased insulation thicknesses required, and the need for a separator between the two coil-sides, increase the depth of the required slot to such an extent that even at a voltage as low as 3·3 kV it is usually essential to use a smaller stator bore diameter than would be necessary for a low-voltage machine with the same outside diameter. These reductions in stator bore diameter and in permissible mean flux density lead inevitably to a greatly reduced output from a given frame, and this is without any consideration having yet been given to the actual detail of the slot content.

Consider now, as an example, a small 6·6 kV machine; suppose that a suitable stator bore diameter has already been selected, and that, as a result of a preliminary estimate of the permissible flux per pole, the total number of stator conductors per phase is known at least approximately. It is now necessary to select a suitable number of slots, and since the factors already noted will have resulted in a relatively low flux per pole (and thus a relatively high number of conductors per phase), it will obviously be desirable for the number of slots to be as high as possible. If this criterion is not met, the number of conductors per slot would be unnecessarily high, and this would be thoroughly undesirable, for reasons which will shortly be apparent. At 6·6 kV the total insulation and clearance in the width of the slot is not likely to be less than about 0·27 in.; in general, moreover, it would not be worth while to use a conductor width of much less than about 0·20 in., so that the minimum slot-width for this voltage might be said to be about 0·47 in.*

Now it is seldom possible to use a ratio of slot-width to slot-pitch much greater than about 0·55; above this ratio the effective air gap area reduces rapidly, and surface iron losses tend to become excessive. At 6·6 kV, therefore, it is scarcely possible to use a slot pitch much less than about 0·80 in.-0·85 in.; corresponding restrictions exist for the other voltages, and the choice of stator slot number is thus severely limited. In practice it will be found that for the smaller outputs at least, the possible number of stator slots is such that the required number of conductors per slot is relatively high, numbers between 20 and 30 being the most usual. At first sight this may appear to be of no great consequence, but it is at this point that the purely mechanical limitations on conductor size and proportions begin to assume an overriding significance.

Coil structure

In the production of a multi-turn diamond-type coil it is necessary for the coil-side (which consists of a number of insulated rectangular copper strips lying one above the other "on the flat") to be bent "on edge" as a whole, and there are limits to the conductor width/depth ratio which can be used if the resulting coil is to be completely satisfactory. The actual limit in a given instance will vary with the size of the conductor and the type of coil-forming machinery in use, but a width/depth ratio of five is seldom exceeded, and many manufacturers prefer rather lower values, especially where the coil consists of a large number of turns of relatively small cross-section.

Suppose now that in the design of a small high-voltage motor the flux loading, and thus the number of conductors per phase, has been settled; suppose also that the number of stator slots has also been settled, and that the number of conductors required per slot is thus known. The width of the conductor being virtually fixed, the designer has then to consider its depth. His first step

* It is not to be expected that all designers will agree exactly with these figures; they are being cited only as an illustration of the way in which the limits in use will inevitably affect the design.

Table I. 50 c/s S.C. Induction Motors with Class A Insulation and to BS 168 and BS 2613 —Minimum Economic Outputs

(Outputs in h.p.)

	Ventilated		T.E.F.C.	
	BS 168	BS 2613	BS 168	BS 2613
4-pole 3·3 kV	125	150	100	125
6·6 kV	300	350	250	300
11 kV	1000	1250	850	1000
8-pole 3·3 kV	100	125	80	100
6·6 kV	250	300	200	250
11 kV	900	1100	800	900

will probably be to see what the conductor depth will be if a slot of a depth provisionally selected as about right for the diameter in use is completely filled. If this "maximum" conductor depth is such as to give about the right cross-sectional area from the purely thermal point of view (i.e., in respect of current density, copper loss and cooling), and if it is also satisfactory mechanically, then all is well. If a larger section seems necessary, and no reduction in the number of conductors is permissible owing to flux limitations, then the frame being tried is too small. But suppose that a depth adequate from the purely thermal point of view is *less* than that which could be accommodated in the total available slot depth, but is only just acceptable mechanically? In such a case the larger conductor—satisfactory mechanically, but of an unnecessarily large cross-section from the purely thermal point of view—must obviously be used. But a machine so designed would have a temperature rise lower than the permitted maximum, which is only another way of saying that it is too large for the required output, and since the winding concerned is already "on the limit" from the mechanical point of view, no reduction in frame size is possible. Thus no matter how much ingenuity is exercised in the design there will always be, for a given voltage, speed, temperature rise, and enclosure, a certain minimum output below which an economic design is impossible.

Factors affecting the limit

A word of explanation about the factors affecting the minimum output may be useful.

The motor speed will affect the output limit because, for a given output, the motor must be physically larger at the lower speeds and it thus becomes progressively easier to build. Furthermore, the cooling conditions usually worsen as the speed is reduced, and the line current increases because of the poorer running power factor. All these factors tend to increase the conductor size, and there is thus a tendency for the minimum practicable output to decrease with speed.

The effect of temperature rise is fairly obvious. The higher the permitted rise, the greater is the possible output from a given mechanically limiting winding, and the minimum practicable output thus increases with permitted temperature rise. This point is particularly important because of the new and considerably higher temperature rises permitted by the "continuous maximum rating" specification BS 2613 by comparison with those allowed by the older "load-plus-overload" specification BS 168; even making a suitable allowance for the new "rise-by-resistance" method now established for high-voltage stator windings the outputs now obtainable are considerably higher for the same class of insulation, and the minimum practicable outputs to the new specification are correspondingly increased. It is also the case that it is often just not possible to take advantage of the properties of class E or class B insulation to obtain a smaller motor for a given output.

The type of enclosure will affect the output limit simply because of its effect on the cooling. In a t.e.f.c. machine, for example, only a strictly limited loss can be tolerated, and much lower current densities than would be possible in the corresponding ventilated motor must be employed. This leads to a physically larger motor, and in particular to a larger stator conductor for the same current, and the minimum practicable output for a t.e.f.c. machine is thus considerably lower than for its ventilated counterpart.

Practicable limits

It is no doubt asking for trouble to make concrete recommendations, but for what they are worth, the author's own rough ideas about minimum outputs are given in Table I, alternative values to the new and old specifications being included to give some idea of the effect of the relatively newer rating and temperature rise philosophy.

In many instances outputs below those cited are probably feasible, but the prospective user would nevertheless be well advised to pause and reflect before buying motors of even the outputs quoted. A price and performance comparison will normally show a considerable margin in favour of the low-voltage alternative; it has always been a mystery to the author why so many engineers should be so enthusiastic about the use of the higher voltages for relatively small motors, and there are several other manufacturing considerations in favour of the low-voltage alternative which cannot be discussed in detail in such a short article. Even where no low-voltage supply is available there is often still no case for a high-voltage motor, since (in spite of a widespread and popular view to the contrary) the total price of a motor/transformer combination is usually more attractive than that of a high-voltage motor until outputs a good deal higher than those in the table are required. The running efficiency and power factor of a motor/transformer combination are also usually superior to those of a high-voltage motor, and if standardisation on high-voltage switchgear is required a solidly connected "unit" transformer, with the circuit-breaker on the high-voltage side, can always be employed.

TIME OUT

DURING my work as an electrical surveyor for an insurance company, I have had to investigate several claims for time lost as a result of breakdowns of electrical machinery. A recent case in which the maintenance electrician really "moved" was at a paper mill where an auto-transformer starter for a 90 h.p. motor developed a short-circuit to earth on one limb of the winding during start-up.

The position was that the electrician had about half-an-hour to get the motor going otherwise the paper machine would have to be stopped, the resulting loss of production costing several hundreds of pounds per hour. The electrician quickly bolted the ingoing and outgoing cables together inside the auto-transformer unit, thus cutting the starter out of the circuit, and then started the motor direct on to the line from its circuit-breaker in the substation. It provides a good example of a case where an electrician, in just doing his job, earned his wages many times over in that half-hour.

The reverse situation occurred on another occasion (involving a different firm) when I was on the premises when they had a breakdown. As the faulty motor was a key machine, part of the plant had to be shut down. Having been burnt out, it was a question of replacing it completely with a sound machine.

The maintenance electrician went off to the stores for another motor and as he was away a long time, I went in search and found him, to my surprise, half-way through his mid-morning tea break. To my mind, the firm concerned would have done better to manage without a maintenance electrician and call in a local contractor for breakdowns and for the small amount of installation work required from time to time.

To refer to auto-transformer starters again, I always suggest having a spare one handy, if at all possible, for emergencies, as they can be used in many cases as substitute starters. They may, for example, be used with a motor having only three ends brought out to the terminal box. Moreover the transformer tappings make the starter very flexible; if the starting torque at one setting is not high enough, it is an easy matter to select a higher tapping. A few direct-on starters available for standby are better still if the supply system will stand this method of starting.

Despite the complicated maintenance schemes in current use, I suppose there will always be breakdowns and I am sure many readers must have interesting ideas on the quickest way of getting things going again, although some of the arrangements I have seen left a great deal to be desired from the safety aspect.

—*"Surveyor."*

CHECK POINTS FOR SAFETY DESIGN

MACHINES break down, but it is men who have accidents. That is the key thought for the safety engineer. How it can be applied in the design stage of machinery and apparatus was discussed* by an engineering psychologist in a paper to the conference held in connection with the recent Engineering Materials and Design Exhibition. The argument is advanced that the designer should have some basic principles to guide his approach to safety. Further, there should be a definite stage in any design schedule where the designer is required to concentrate solely on operator and safety factors.

Safety principles

The fundamental principle of safe design is to try to produce an equipment which is so well adapted to the operator that he never makes a mistake. The check for the designer is whether the demands of the equipment on the operator are well adapted to his natural shape, size, abilities and expectation of what may happen. It is necessary to give thought to the situation when the machine is on full load with the operator going through his whole work sequence. Any misfit between design and operator increases the chance of an accident.

Next to this basic principle comes the need to achieve sound engineering design, with full consideration of operating conditions as far as these affect wear and tear—including the end result of *unfair* wear and tear. This is another way of putting the question: will the apparatus fail safe? (As recent articles in *Industrial Electricity* have stressed, this is often a question of the precise way in which springs are used.)

The third basic principle is that if the operator does make a mistake, or if the equipment fails, the mistake or failure should not result in injury. This can only be achieved by preventing contact of the body with potentially injurious hazards, either by redesigning to remove the hazard or by enclosing it with protective guards. To be fully effective, suitable guards and safety devices should be an integral part of the original design, not something added later.

A fourth principle is that unless there are exceptional reasons, which are clearly obvious to all, the guards or safety devices fitted to a machine must in no way hinder the operator in the efficient and speedy performance of his task. Behind this recommendation lies consideration of the frequent cases heard of where perfectly safe but obstructive guards have been thrown away by operators in the interests of their immediate financial gain—though to their ultimate personal cost. When such an incident occurs, the designer should be considered equally guilty with the operator.

There is another twist to this last consideration. Bad safety devices are *worse than useless* because they are defeated by the operator in a mood of annoyance; and annoyance is something which can make an operator more accident-prone.

Conclusions

In his concluding summary of his paper, Mr Shackel remarks that although the historical and legal background of safety places the onus rightly on the employer to preserve potentially safe conditions, this attitude has resulted in too little emphasis on the designers' responsibility. He feels that there is a need for more feedback of information from the machine user to the machine designer; for more statistics, and for better guides for designers. Given adequate knowledge and advice, the designer probably needs time and an explicit instruction to ensure that he makes the mental effort required to give full weight to safety considerations.

* Engineering Design for Safety, by B. Shackel, M.A., EMI Electronics Ltd.

Computer-controlled Steel Mill

UNDER construction in Detroit, Michigan, US, to supply automobile makers is what it is claimed will be the world's fastest and most powerful continuous hot strip mill. A distinguishing feature will be incorporation of an automatic digital computer system. "The most complete control system yet to be installed in a steel processing plant," the manufacturers of the control system (Daystrom Incorporated's Control Systems Division of La Jolla, California) claim. Behind the contract stands a guarantee which has been described as unique in the industry. It underwrites the system's operational availability 99% of the time in a six-month reliability test.

In essence, the system—a completely transistorised general-purpose digital computer with a magnetic core memory—will control all operations of the hot strip mill from the time slabs of steel enter the line at one end until they come out the other in the form of rolled coil, the finished product.

To accomplish this job the system will do two things.

It will monitor 200 key points along the route that the steel takes in the mill and feed this information into its computer. At the same time, it will accept information offered it by means of punched paper tape. The punched-tape data will include such information as the number of slabs called for by the mill's production schedule as well as characteristics and specifications of the product design.

Working continuously on this information at the rate of 44,000 computations a minute, the computer will follow each slab through its processing though it moves at the rate of 3,000 ft/minute. It will automatically control temperatures and tighten or loosen screwdown rollers or width controls until the slab emerges to fit predetermined specifications. At the same time, the system will automatically record detailed information on each slab and give an alarm if any part of it begins to fall off pre-set standards.

A similar control system designed into the US Louisana Power and Light Co.'s system at Sterlington, completed a test run of six months during which it operated 99·75% of the time. Availability at this level is achieved by utilising proved circuitry so de-rated that it is called upon for only a fraction of its capability, by eliminating moving parts and by using solid-state components instead of electronic valves.

Daystrom's "confidently expect this system to help this mill produce steel to a tighter width gauge tolerance, enabling it to turn out a consistently higher quality product than the industry has ever known before. The mill will have greater horsepower than any in the world. Its capability will be too fast for human reaction to realise consistently its highest potential."

CONTROL GEAR GLOSSARY

FOLLOWING the publication of our Data Sheet No. 36, which gave equivalents in French, German, Italian and Swedish of common control gear terms, we have received comments suggesting alternatives. Most of these concern the Swedish list, as follows:

d.c.	Likström
load, h.p.	Belastning, h.k.
rating *could be*	Märkeffekt
setting	Inställning
no load *could be*	Obelastad
continuous rating	Kontinuerlig drift
intermittent rating	Avbruten drift
output	utgiven effekt / utgångseffekt
neutral	Noll (stjarn) punkt
starter *could be*	Igångsättare
terminals	Klämmor

It should also be noted that "Effektfaktor" (=power factor) is one word.

Of the German terms, the following alternatives are suggested:

Isolator	Trennschalter
Contactor(s)	Schütz(e)

ELECTRO-MAGNETIC CLUTCHES

A SURVEY OF AVAILABLE DESIGNS

by E. R. Brooke, M.I.E.E., A.M.I.E.D.

THERE is an increasing emphasis today upon all forms of remote control; as the electro-magnetic clutch provides a direct link between mechanical power and electrical control its potential value is now being realised and many varieties of clutch have become commercially available.

Rotating Coil Type

(a) Simple plate clutch.

(b) Plate clutch with special friction material.

(c) Plate clutch with conical friction surfaces.

(d) Plate clutch with additional floating disc.

Fixed Coil Type

(e) Magnetic slip-ring clutch.

(f) Binder clutch.

Most of these varieties can be obtained combined with a magnetic brake, but this dual purpose form is not included in this resumé. All the clutches described herein are for d.c. operation.

Common Characteristics

The torque-carrying capacity of all magnetic clutches is limited by the wattage which the surface area can dissipate for an allowable temperature rise. In addition, the slippage creates heat through friction and this is a factor which often limits the application, particularly in servo systems. The equivalent diameter of the friction circle, the magnetic pull, the coefficient of friction and the configuration of the mating surfaces are other factors which control the transmitted torque.

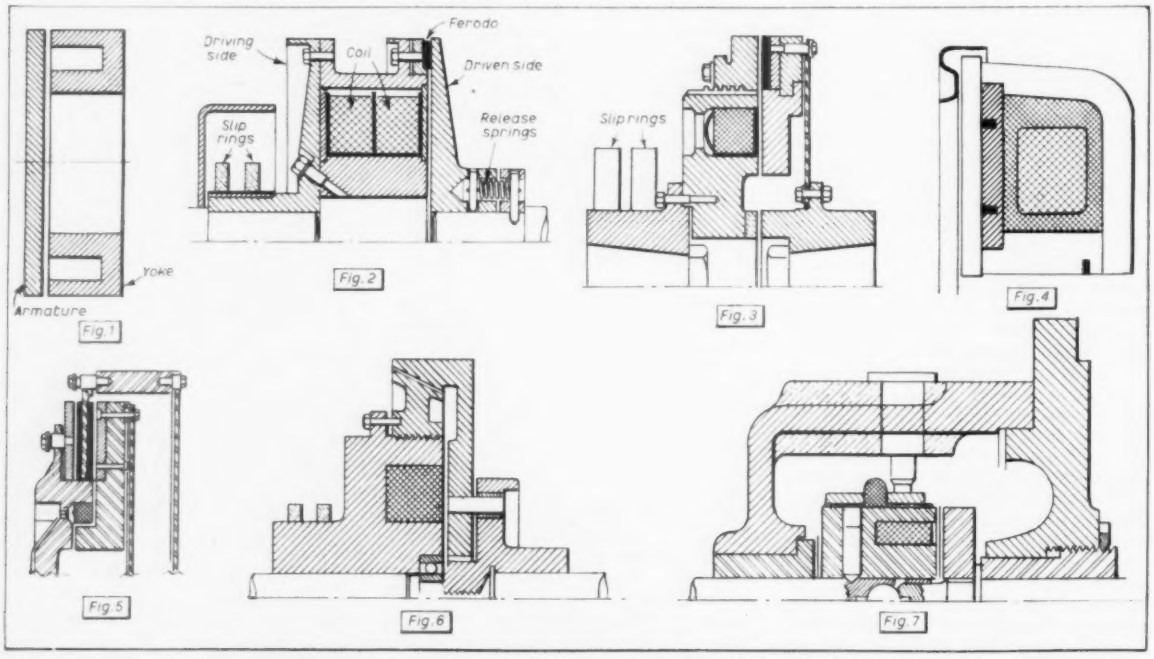
The magnetic pull itself is a function of the ampere-turns, the flux carrying capacity of the iron circuit, the effective airgap and the surface area of the pole faces. It can be seen, therefore, that the relationships between all these items which contribute to the final torque capacity is a matter of some complexity and it is not intended to deal here with the mathematical relationships involved.

A rather empirical factor which takes into account both the torque capacity and the maximum diameter of a magnetic clutch is the static torque/inch of outside diameter of rotor. If this criteria be plotted against power consumption, an interesting comparison between clutches of different types can be made. Fig. 10 shows such a plot for some of the varieties discussed; the units of the criterion factor are lb-ft/in. and the figures against the points are those of outside diameters of rotors.

Rotating Coil Type Clutches

Simple plate clutch—Type A. The traditional type is the plate clutch shown in Fig. 1 consisting, in its simplest form, of an annular electro-magnet of U-section acting upon a circular plate of magnetic material.

This clutch is most used in low torque applications where small size and long life are the main requirements. A typical instance of its use is in an echo-sounding chart recorder where it provides the connection between a constant speed motor and a winding drum. The stylus is connected to a thread wrapped around the drum and at selected intervals the clutch is energised, causing the stylus to move across the chart at a steady speed representing the speed of sound in water. At the end of its stroke the clutch is de-energised and the stylus flies back under the action of a spring. The author has not found it possible



Figs. 1 to 7. Rotating coil type clutches; cross-hatching shows coils. Fig. 1. Simple plate clutch, type A; cross-sectional view. Fig. 2. Typical section of type B clutch with special friction material. Fig. 3. Type B clutch showing spring-plate mounting. Fig. 4. Type B clutch showing location of friction material (heavy shading). Fig. 5. Type B clutch showing double friction lining. Fig. 6. Type C clutch with conical friction plate. Fig. 7. Type D clutch with additional floating disc. (All sketches are simplified versions of the originals)

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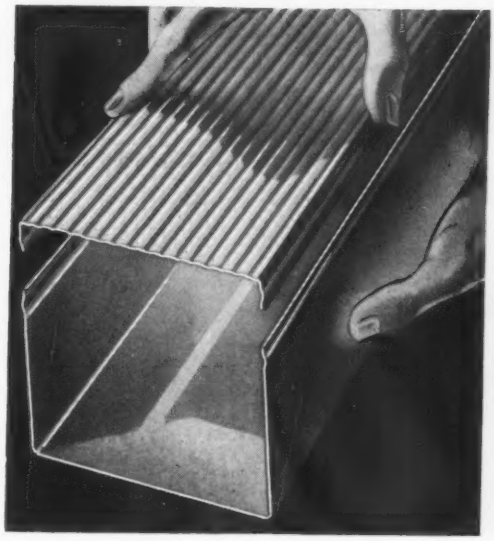

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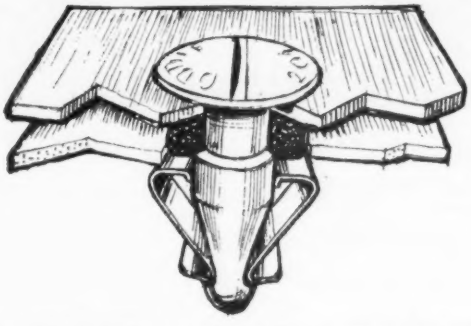

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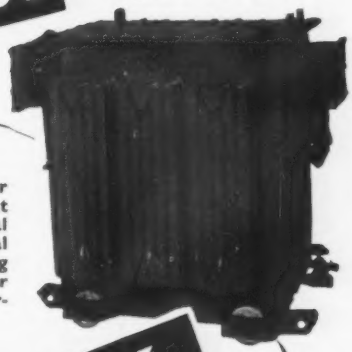

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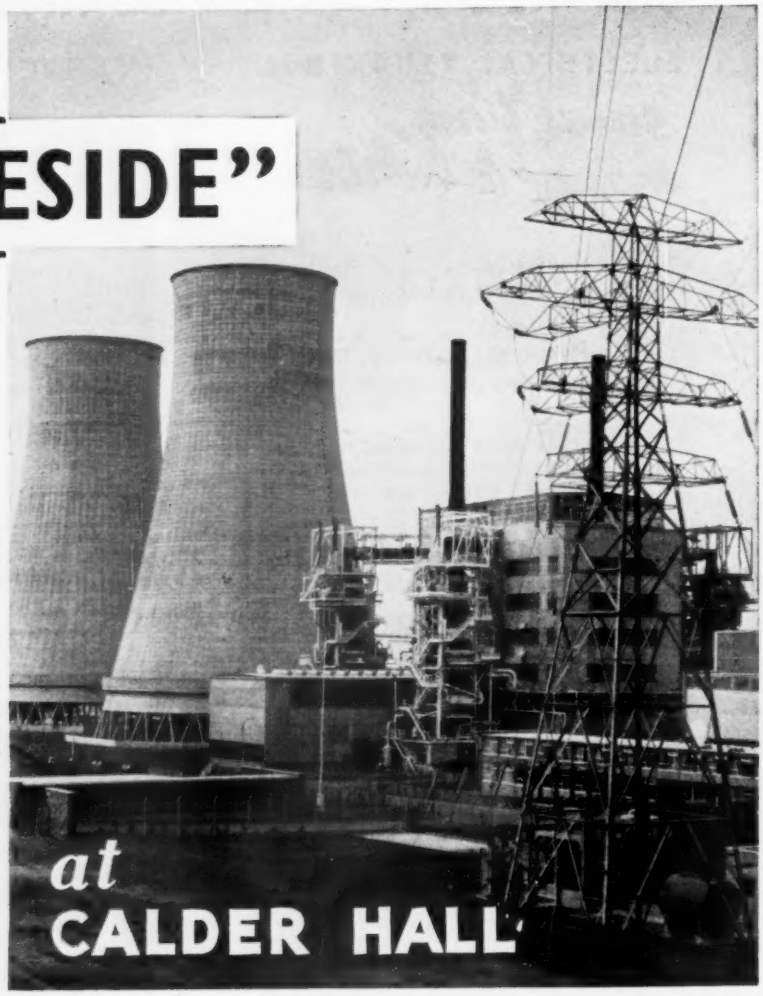

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to plot a criterion factor for this type of clutch as no reliable figures are at hand.

Plate clutch with special friction material—Type B. To improve the torque carrying capacity of a plate clutch a ring of brake lining material can be fitted so that it meets the plate before the airgap closes. A typical example of this form is shown in simplified form in Fig. 2, which illustrates also how helical springs are utilised to disengage automatically the armature from the friction face when the excitation current is switched off. Another method is to use a spring plate or diaphragm, see Fig. 3. Obviously, the greater effective radius of the friction surface, the greater will be the torque transmitted, all else being equal. However, this results in a large outside diameter which is not always acceptable now that miniaturisation of equipment is a general trend. A compromise which also reduces the inertia is to put a ring of friction material against the coil as shown in Fig. 4, and this is often done in clutches used in instruments. A further method of increasing the torque capacity and the life of the friction surfaces, is to provide a double friction lining, see Fig. 5. Another advantageous feature of this duplex construction is that the two magnet members rotate together and so the magnet faces cannot be scored when the linings become worn.

The plot in Fig. 10 shows figures characteristic of this type of construction, but it must be remembered when comparisons are made that the diameters plotted represent the small end of a range of clutches up to 50 in. diameter. These are designed for onerous duties in such applications as rolling mills where neither the size nor the wattage are of special importance in themselves. The design is representative of traditional heavy engineering practice.

Plate clutch with conical friction surfaces—Type C. Fig. 6 illustrates a plate-type clutch having coned friction surfaces. The chosen cone angle is such that a greater interface pressure is obtained for a given axial force, but there is a fight here between length of airgaps and cone angle. As very few such conical magnetic clutches are available, it is probably safe to assume that little can be gained by adopting this form of construction, leading as it does to expensive linings. Fig. 6 also shows a method of carrying the torque through pins rather than the key used in Fig. 2. This is advantageous, as at the increased radius, the force component of the torque is reduced, making for longer life and a reduced axial force necessary to open and close the gaps. Here again no performance figures are readily available.

Fig. 10. Performance criteria curves for clutches of different types

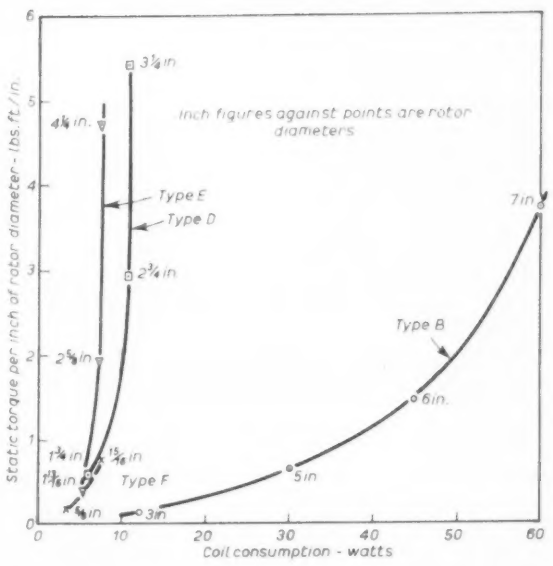


Plate clutch with additional floating disc—Type D. A development in recent years which is claimed to reduce the weight/power ratio considerably is illustrated in Fig. 7. The usual annular magnet and plate are given highly polished glass-hard faces and between them is placed a flexible floating disc of high permeability which is not physically attached to either member; this whole assembly is immersed in an oil bath. When the coil is energised, the pole faces make contact with the floating disc which joins up the lines of force. The manufacturers of this patented clutch claim that its action does not depend on friction as the torque is the result of electro-magnetic adhesion and is independent of speed; further, they state that it may be continuously slipped at a much greater energy figure and temperature than any other clutch because, at slip, practically the full torque is electro-magnetic so that the energy loss is dissipated throughout the body of the unit.

As will be seen from Fig. 10, this type of clutch is an efficient one and it is made at present in sizes up to 9 in. diameter giving up to 36 ft lb/in. dia (static torque) for 72 watts consumption.

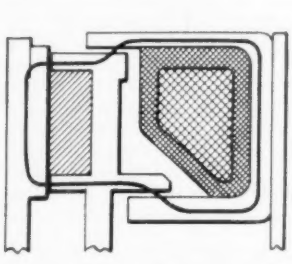
Fixed Coil Type

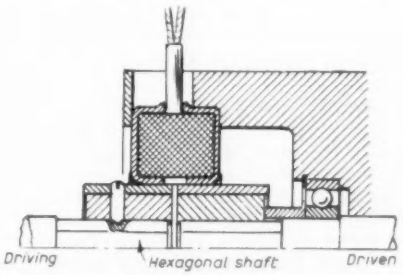
Magnetic slip-ring clutch—Type E. This type of clutch consists of three concentrically mounted components illustrated in Fig. 8:

1. A U-section yoke with elongated pole-faces. The coil is carried within the yoke which is bolted to a stationary member of the machine.
2. A rotor, usually secured to the driving member. This is a composite unit made of two magnetic rings joined by a non-magnetic component. The two magnetic rings underlie the elongated pole-faces of item 1 above, forming a magnetic slip-ring. A ring of friction material is embedded into the channel space between the magnetic rings.
3. An armature or clutch plate of the normal kind, splined to a hub secured to the driven member. The splining allows the armature to move axially against the rotor when the clutch is energised and automatically compensates for wear.

As brushes and copper slip-rings are eliminated in this design, a long life without attention can be confidently expected and the curve in Fig. 10 shows that the torque capacity is indeed high. Sizes up to 4¼ in. diameter are currently manufactured. Precision mounting is necessary to maintain the concentric airgaps.

Binder clutch—Type F. This very simple type of clutch is shown in Fig. 9. The coil is contained within two dished rings of iron and there is a gap between the two poles formed on the inner diameter. Below these poles two rotors are mounted about 0·010 in. apart, each on separate shafts with independent bearings and they run, with as small an airgap as possible, concentric to the fixed poles. One rotor is capable of axial movement and when the coil is energised, the two rotors become clamped together, thus completing the magnetic circuit. Fig. 9 involves the provision of a thin bronze bearing between the poles and the rotors. Here again precision mounting is necessary to maintain





Figs. 8 and 9. Fig. 8, left. Fixed-coil type clutches. Type E clutch, showing magnetic slip-ring action. (Heavy line shows magnetic circuit.) Fig. 9, right. Type F clutch, binder type

the concentric airgaps. An advantage peculiar to this construction is the low inertia of the rotating system because of the small rotor diameters used.

Conclusions

The figures used in Fig. 10 are derived from manufacturers' catalogues and they allow a prima facie comparison to be made for clutches up to 7 in. diameter. From the general grouping it would appear that Type E, the magnetic slip-ring clutch, is the most efficient, followed closely by Type D, then Type F and, somewhat well removed, Type B. It should be noted, however, that the outer casings for types D and F are often of a diameter up to twice that of the rotor.

In the choice of a clutch for a specific purpose, factors other than torque, diameter and watts have to be taken into account. The maintenance-free life, ease of fitting and replacement, the possibility of misalignment and its effects, the effects of lubricants and problems of inertia and response time are some of these factors.

FOOD FACTORY LIGHTING

DUSTPROOF FITTINGS ACCESSIBLE FROM OUTSIDE

TO ensure maximum cleanliness, the working area of Rowntree and Co. Ltd.'s new branch factory at Fawdon has been lighted with specially designed fluorescent fittings, either dustproof or with sealed "Perspex" diffuser bowls and with provision for service from outside the working area. The fittings used, shown in our illustrations, have been supplied by AEI Lamp and Lighting Co.

In the multi-floor areas, general lighting is by 5 ft fluorescent dustproof fittings, each housing one 80 W lamp. These fittings were first developed in conjunction with Rowntree's engineers for use in their factory at York, where a number of them have been in use for over five years, without needing internal cleaning. Access to the fitting for re-lamping is via a felt-gasketed end panel. Clear plastic guides are provided to allow a lamp to be inserted easily in the lampholders (Fig. 1).

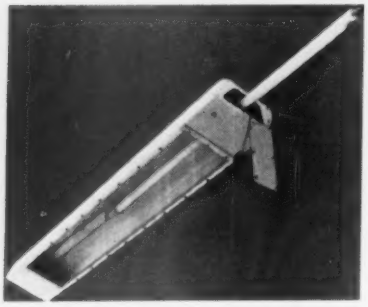


Fig. 1. Dustproof fitting with end-plate removed to give access for re-lamping

In the section of the building roofed with shell concrete, over 400 AEI special "shell concrete" 5 ft fluorescent fittings, housing from three to seven lamps, are installed in openings formed in the roof during its construction. These fittings are installed and serviced on top of the roof. Protective blown "Perspex" bowls are lowered into the cavity before the fitting is installed, when an effective seal is required between the working area and the fittings.

Fig. 2 (above). Access to control gear and lamps is readily obtained from the roof without disturbing factory production

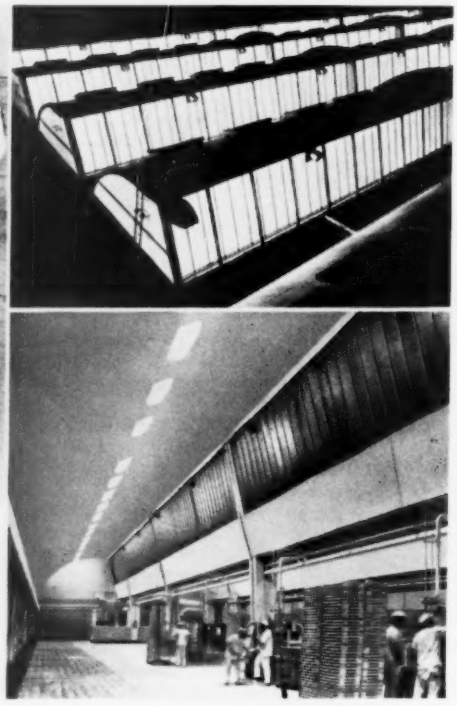


Fig. 3 (above, right). Night view of shell concrete roof, showing covers over fluorescent fittings

The illustrations give an impression of the manner in which the lighting fittings are applied. Fig. 2 shows how the fittings are dropped into position in the holes left in the shell concrete roof, the protruding receptacles for the fittings showing up in silhouette in Fig. 3, which also gives an impression of the generous amount of daylighting provided in this design of factory roof.

General Considerations

The question of lighting in food factories is always one of some concern to the engineers involved, because of the paramount need to avoid any foreign matter getting into the product that is intended to be eaten. This foreign matter can come from the lighting installation in two ways. Most directly, there is the risk that breakage of a fitting or a lamp may cause glass to get into the product. Secondly, there is the indirect possibility that an ill-designed lighting fitting will harbour dust and other airborne contamination which can find its way into the food being manufactured. The fittings described and the method of installation are clearly seen to give protection against both these possibilities.

Fig. 4. Night view of factory, showing 5 ft fittings in holes left in concrete shell roof of building

Another field of application for lighting fittings having access from outside the shop they illuminate, is where there is some risk of explosion, as in munitions factories. In this case, special arrangements have to be made about the glass facing through which the lamps illuminate the danger area.

Power rectifiers in industry

FACTORS IN THE APPLICATION OF STATIC CONVERTORS

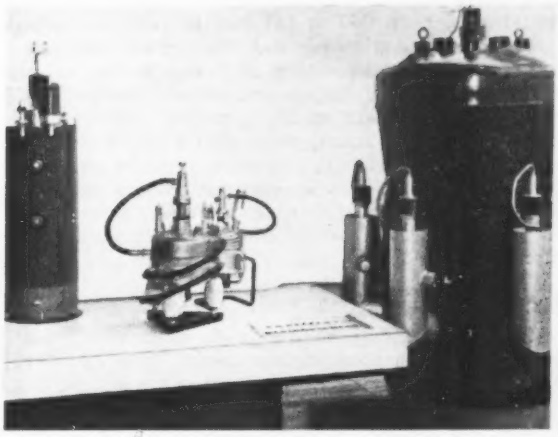
MERCURY arc, copper oxide and selenium rectifiers have now enjoyed a well-merited popularity in industrial use for many years. Since the war, however, a significant increase in demand for static rectification plant has been accompanied by a radical changeover to the relatively new silicon and germanium types in fields previously considered to be the almost exclusive domain of the mercury-arc. Despite this, the demand for the latter has not declined. This may be accounted for partly by the modernisation and replacement programme on our railways and partly by the extension of their use as controllers for medium and heavy duty machine drives where Ward-Leonard, Ilgner and similar rotary machines had held sway.

The industrial designer today has, therefore, a wide choice of static rectifiers to select from and, though in many cases there will be little to choose between one type and another for a specific duty, it is essential that he should be fully conversant with the considerations, both technical and economic, which he must take into account when making his decision. These have been concisely outlined in a paper* presented last week before the Utilisation Section of the IEE in London. It was, perhaps, significant that in the paper the author made no mention of the copper oxide rectifier. Despite its early predominance in the field of static rectification there is evidence that it is now being largely outmoded by modern monocrystalline (germanium, silicon) and polycrystalline (selenium-iron) semiconductors.

Choice of Equipment

Broadly speaking, mercury-arc types are most suitable for heavy duty applications, such as d.c. conversion in substations for traction, large machine drives and high power switching, or where fast or sensitive voltage regulation is essential. Semiconductor rectifiers are more suitable for high current, low voltage (e.g., electrolytic processes) or high voltage, low current (e.g., electrostatic precipitators, etc.) conversion but are also being increasingly used in other fields where rapid or close voltage regulation is less important. As the performance of monocrystalline semiconductors improves, the tendency is to swing over to them rather than to the polycrystalline type.

Semiconductor rectifiers are simpler to construct, install and service than mercury-arc and are usually more compact with efficiencies of 92% for polycrystalline and 94% —98% for the monocrystalline types. Efficiencies for mercury-arc rectifiers vary with design and shape but are of the order of 82%—98%, the higher efficiencies being obtained with equipments in the upper voltage range.



Comparison of size of conventional single and multi-anode mercury-arc air-cooled rectifiers with, on the table, their water-cooled equivalents (GEC)

Pulse-number and Waveform

The pulse-number, or number of main crests produced per period of supply frequency, should be six or more for satisfactory commutation and heating on variable speed motor drives or for traction. The d.c. waveform can be improved by the addition of a suitable amount of inductance in the circuit, but this will reflect harmonics back into the a.c. supply and a compromise is usually necessary. A chart issued by the Electricity Council Chief Engineers' Conference to local area boards, reproduced in Fig. 1, suggests a limiting relationship between rating, pulse-number and system short-circuit capacity for general conditions, but this does not apply to railways or to rectifiers employing wide-range grid control. On the basis of these curves, the permissible load should not exceed 50%—80% of the values given, depending on the degree of grid-firing delay and number of phases.

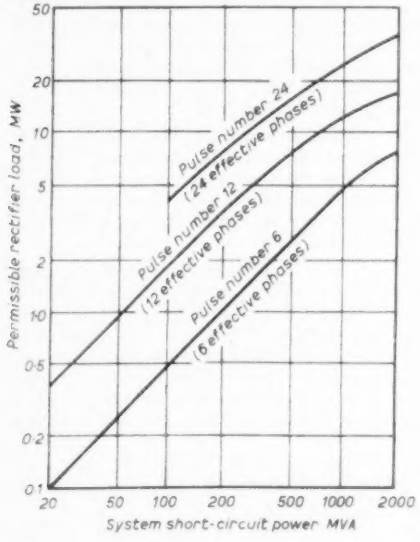


Fig. 1 (left). Curves relating rating and pulse number to system short-circuit capacity

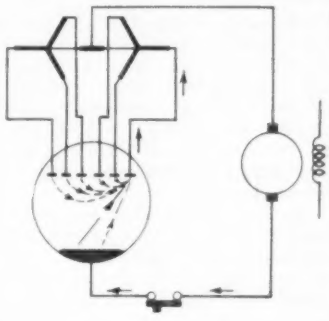


Fig. 2 (above). Backfire in a mercury-arc rectifier driving a motor

Power Factor

The rectifier manufacturer has practically no control over the power factor of his equipment. This is determined by the transformer reactance and magnetising current and will

* Paper No. 3215: "Some Considerations in the Application of Power Rectifiers and Convertors," by J. P. McBreen, A.M.I.E.E. (Heavy Plant Division, AEI).

range from 0·95 to 0·97 at full load to very low values at light loads on grid-controlled mercury-arc and semiconductor rectifiers. Reversing mill and winder drives of any magnitude can impose considerable fluctuation of the a.c. system voltage which, in certain circumstances, could be a source of annoyance to other supply consumers.

Schemes, such as Bedford's rectifier sequence control—two half-voltage rectifiers in series controlled in sequence from full inversion to full rectification—are satisfactory, but the expense and complication are only justified in extreme cases.

Rectifier Connections

The author details a number of the more widely used rectifier/transformer connections, giving pulse numbers from three to 24 from a three-phase supply. It is important to remember that while double way or "bridge" connections are possible with semiconductors, they are not possible with multi-anode mercury-arc rectifiers and can only be applied to single anode working at a sacrifice of efficiency. For satisfactory parallel operation of multi-anode rectifiers a separate winding on the transformer or a reactor in series with each anode is necessary to ensure load sharing.

Both mercury-arc and semiconductor rectifiers can be made to operate in parallel with other types of static or rotating rectifiers by matching their regulation characteristics and they can also be applied to three-wire d.c. system working.

Faults and Prevention

The most serious fault which can take place in a static rectifier unit is a "backfire." This is a condition in which, through a variety of circumstances, the normally high forward resistance to the passage of current breaks down, imposing a "short-circuit" on the transformer and also across the d.c. system (Fig. 2). The fault current is limited by the a.c. impedance of the transformer winding and may reach 60 times the normal full load current, a state which is only exceeded by a line fault on the d.c. side.

Provided that the protective system clears the fault quickly, a mercury-arc rectifier can be returned to service immediately the cause of the "backfire" has been rectified. With semiconductor rectifiers, part or all of the cells will be destroyed by a "backfire" and will have to be replaced. The most frequent cause of a "backfire" is excessive temperatures, but high voltage surges impressed on the system are also responsible. The relatively low forward resistance of the monocrystalline semiconductors necessitates the inclusion of fault-limiting reactances in circuit; polycrystalline semiconductors have a higher forward resistance and limiting reactances can usually be dispensed with. Adequate cooling is essential with all semiconductor rectifiers.

Mercury-arc rectifiers will not give stable operation at temperatures much below 5°C and, where such ambient conditions are to be expected, provision for local warming must be made during the starting-up period. Their operation depends at all times, of course, on the maintenance of a high degree of vacuum within the arc chamber.

Protection

The paper deals at some length with protection requirements both on the a.c. and d.c. sides of the rectifier. These include the provision of overload and earth fault protective devices on the a.c. circuit-breaker supplemented by h.r.c. fuses in series with individual banks of semiconductor elements or anodes of mercury-arc rectifiers, arc suppression on the latter by applying negative bias to the grid. On the d.c. side, circuit-breakers should be of high-speed or semi-high speed type if the supply capacity to the d.c. system exceeds 4,000 amps or 500 volts.

DISCUSSION

Dr W. G. Thompson (GEC) opening the discussion, referred to the statement that, for equivalent rating and operating conditions, germanium and silicon rectifiers were more compact than mercury-arc rectifiers. While this might be true in regard to conventional air-cooled units, his company had been able to produce water-cooled mercury-arc rectifier equipment which would occupy the same space—and at higher voltages a smaller space—than their semiconductor equivalent. Both single and multiple anode units had been made and grid control had been tried on the smaller units with significant success. Some of these units had already been working for more than six months satisfactorily.

In regard to table 2 of the paper from which it appeared that the "breakeven" point of efficiency between the types of rectifier lay between 1,000 and 1,500 V, with the water-cooled units the "breakeven" point was nearer 750 V and this gave it an advantage in efficiency. He showed a picture of the units (reproduced on the previous page) which clearly demonstrated the relative sizes. These units were capable of standing up to a very high reverse voltage and were quite happy at 1,500 V. Two in series, or in a bridge circuit like semiconductor rectifiers, were adequate for 3,000 V.

There was a tendency to dismiss the mercury-arc rectifier in favour of the relatively new types of semiconductor, but it had to be remembered that the former had given very many years of highly successful operation with few breakdowns. Where trouble had been experienced, such as frequent backfires, it could often be traced to causes outside the rectifier itself. The proper solution to any mercury-arc rectifier problem was an initial understanding of all the factors and conditions of the application and what was to be expected from it in service.

Mr T. B. Rolls (Merz and McLellan) complained about the poor power-factor obtainable with mercury-arc rectifiers without grid-control. In some districts tariffs made it a profitable proposition to correct to 0·98, but this could not be done with rectifiers. He thought that each rectifier should incorporate its own power factor capacitor to correct to lead and this could be used to cover up the sins of motors or other lagging power factor equipment.

Dr J. C. Read (AEI Rugby) said that in the last few years there had been a torrent of highly biased literature on the relative merits of silicon and germanium semiconductor rectifiers. The limiting temperature of germanium (75°C) and silicon (150°C) had nothing to do with reliability. All it meant was that the loss, about the same in each case, could be dissipated in a smaller space with the silicon rectifier, but perfectly satisfactory rectifiers could be made with either material so long as the heat dissipation arrangements were adequate. While theoretically silicon could be operated at higher voltages than germanium this was complicated by the fact that manufacturers could produce neither material to uniform quality.

Mr P. Whitaker agreed that the CEA code ensured that mutilation of the supply by harmonics did not take place, but felt that it was conservative and should be kept under review in the light of field tests.

Mr J. A. Broughall (British Transport Commission) remarked that since the air cooled multi-anode rectifiers on the Liverpool St/Shenfield line were described in an IEE paper in 1949, nothing had been heard of them for the simple reason there was nothing to say. They just kept on working and had given no trouble.

Mr D. J. E. Evans (Kennedy and Donkin), Mr F. Moores and Mr J. M. Waddell also took part in the discussion to which the author briefly replied.

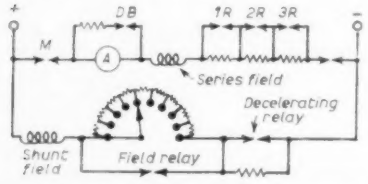
PROBLEMS AND PRACTICE

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

Elusive break

PLANT under my care in a steel works includes a welding machine in which coils of steel strip are passed through a flattening machine, welded and then taken through a second set of rolls on to further processing. The flattener and rolls are separately driven, although their speeds are synchronised. The complaint was that the rolls were slowing down whilst the strip was travelling at full speed, causing dangerous loops. The usual on-the-spot checking was made, but no visible evidence was found; as the fault was intermittent, it was only after many hours of searching that it was discovered and put right.

The two drive motors concerned are 250 V, compound wound d.c. machines, one of 20 h.p., the other of 35 h.p. Their control was identical, involving, as shown on the accompanying sketch, series resistance steps, dynamic braking and shunt rheostat with the usual accelerating and decelerating contactors controlled by two individual controllers with five speed steps, the last step giving a strip speed of 366 ft/min.



Control circuit of steel mill auxiliaries, in which intermittent failure of field relay occurred

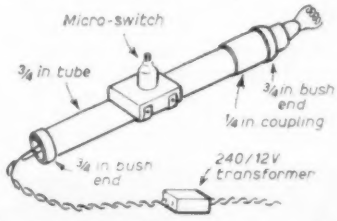
The obvious points of failure were examined—high resistance of controller and auxiliary contacts; continuity of wiring, coils and motor windings; insulation resistance—but nothing amiss was discovered. At no time was anyone able to see any particular contactor fail to perform correctly, although the fault was continuing to occur from time to time. Eventually, all contacts and springs connected with this sequence were removed completely and the panel overhauled, but the fault still persisted.

All contactor coils connected in this sequence were then renewed and the fault disappeared. As no-one could pinpoint a particular contactor as being the cause, all coils were eventually examined and in the coil operating the field relay we found a minute break, which must have been intermittently opening as the temperature varied or vibration increased. As this relay, when de-energised, short-circuits the shunt rheostat, the slowing down was provided. This coil, along with the others, had been tested at least twice for continuity and gave a satisfactory indication.—*L.P.*

Lighting up

IN an engineering works where they produce oil and gas heaters which are electrically fed and controlled, the electrical staff, assisted by the gas fitters, were required to test a large number of gas heaters. The electrical equipment provided on these heaters comprised flue controls and an over-heat fan control, actuated by means of a mercury switch, which operates when the combustion chamber heats up. This mercury switch also brings in a cascade fan which distributes the hot air and also provides cooling during the summer.

During the initial testing of these heaters, certain teething troubles were experienced which involved replacing one or two components, for which reason it was impossible to ignite the pilot jet automatically. We were, therefore, faced with the need to light the jet on each heater by hand. Since the jet is situated about 18 in. inside the combustion chamber, and accessible only through a small aperture, our first expedient—a length of rolled-up paper—proved to be rather tedious.



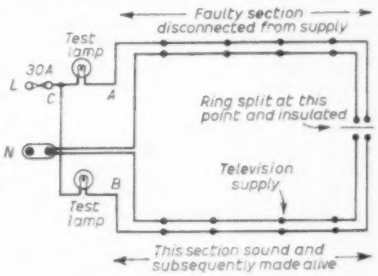
Simple electric lighter made up for routine testing of gas heaters

We found it much simpler to devise our own electric gas lighter, modelled on those battery-fed devices sold for domestic use. For our filament we used a short length of Eureka resistance wire, wound into a small coil and soldered into the cap of an old bulb from a pocket torch. The lamp cap was housed in a length of ¾ in. conduit, with a fitting at each end to put a finish to it. A microswitch salvaged from the junk pile was fitted to the conduit and the filament energised through this from a 12 V bell transformer, to make an efficient lighter.—*F. R. Ralph.*

Earth on the ring

A SHORT time ago, I was called out at short notice towards the end of the day, at a time when no "Megger" insulation tester was to hand and no time was available to acquire one. Consequently, I had to set out armed only with pocket tools and the proverbial test lamp.

Arriving at the house, I was soon acquainted with the need for speed. The complaint was that the ring circuit fuse had blown. I quickly removed all appliances from their various sockets, giving them a quick look, together with



Ring circuit with faulty section isolated to give temporary service on sound section

their plugs and all socket-outlets, in the hope of getting a clue as to the cause of the trouble. Inspection of the consumer's control unit showed that only one spare 30 amp fuse was available, which, of course, I had to preserve.

My next step was then to split the ring circuit into two at a socket-outlet; as shown in the accompanying sketch. The open ends on one half of the ring were sealed; the ends on the other half re-inserted into the socket-outlet. The two phase leads connected to the fuse in the c.c.u. were separated, one lead at a time then being connected in series with the test lamp and the fuse way after having inserted the 30 amp fuse.

When first connected between A and C, the test lamp lit up, indicating a fault to earth. This lead was, therefore, left disconnected, and insulated for safety. Connecting the lamp between A and B gave no indication of a fault to earth, which seemed to indicate that this half of the ring was clear enough to be reconnected to the fuse way. This was done, and the socket-outlets checked to ascertain those still in service, thus providing the consumer with some live sockets for use that evening. Location and rectification of the fault was left until next day.—*J. H. Robinson.*

equipment for industry

Heavy duty terminal blocks

THE "Kabi" range of terminal blocks has recently been extended to include units suitable for currents from 120 to 300 A. These blocks are available in up to 12 ways. They have p.v.c. side shields and their electro-tinned brass terminal studs and links are made in one piece. Brass cable sockets are supplied to suit the conductor size used and each block has a labelling strip. Transparent p.v.c. shrouds are available for each unit. A special non-inflammable version of the company's two-way, 5/15 A terminal block is now available, moulded in a heat resisting material which will withstand almost 500°C. *Precision Components Ltd., 13 Byng Rd, Barnet, Herts.*

Long life switchfuses

UNLIMITED full-load switching is the brave claim made for the GEC "Hidutac" range of switchfuses which are initially available for current ratings from 15 to 60 A in 440 V a.c. circuits. Basis for the claim are type tests at 50% overload of switchfuse units controlling tungsten filament lighting loads with high inrush currents. Units were in good working order after 50,000 operations. These units will break eight times full-load current and are, therefore, suitable for starting squirrel cage motors direct-on-line. Construction of the units is also unusual. The switch has slow-break, silver contacts operated by a cam. This cam is rotated by a front-operated plastics handle. When the unit is assembled the porcelain switch housing is safely concealed behind an insulating plate which also shrouds terminals, and the usual interlocks are included between cover and base. The cover lifts off to give access for wiring and has a p.v.c. gasket. A pressed steel case is used, designed for locations where appearance is important. *GEC Ltd., Magnet Hse, Kingsway, W.C.2.*

Reliable recording and control

TEMPERATURE, pressure and other quantities representable by electrical signals are said to be controllable, accurately and with complete dependability by the "Xactrol" potentiometer recorder. The instrument has what is claimed to be a unique zero-load and zero-differential control which dispenses with snap-action switches in the control circuit. The system operates through sliding contacts on a variably positioned pick up track. This zero-differential feature ensures that control is exerted at exact predetermined point on the scale both for increasing and decreasing pointer deflections. The recorder has a 6 in. scale, accuracy at f.s.d. of 0·25% and a sensitivity of 0·15%. The chassis can be slid out of its case for ease of servicing. It is enclosed in a sheet steel case with plastics door and requires a panel cut out only 10½ in. by 9½ in.

When used as a temperature controller, sensing elements can be supplied for measurements in the range −200 to +2,000°C. The controller is arranged to disconnect supply to a furnace if its own supply fails. Chart speeds can be either 1 or 2 in. per hour and f.s.d. is obtained with from 5 mV to 100 mV by using a range change, plug-in printed-circuit. *Ether Ltd., Caxton Way, Stevenage, Herts.*

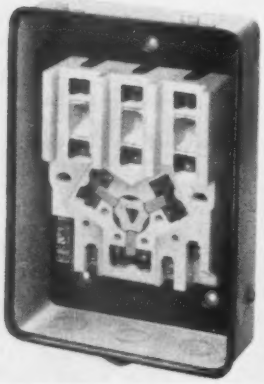
Tape recorder jacks and plugs

A JACK-PLUG suitable for use with screened or coaxial cable associated with tape recorder or telephone circuits and with the standard ¼ in. electrode has been introduced, finished in either polished chrome or gold plating. A version suitable for use with continental equipment is available having a 6 mm diameter electrode. The new jacks are of moulded construction with either closed or open-circuit contact arrangements. Exceptionally high insulation resistance and a capacitance of 0·8$\mu\mu$F are claimed for the sockets. *A. F. Bulgin and Co. Ltd., Bye Pass Rd, Barking, Essex.*

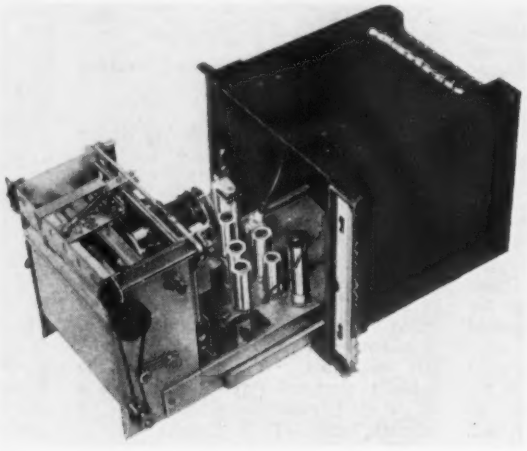
Thimble-size micro-switch

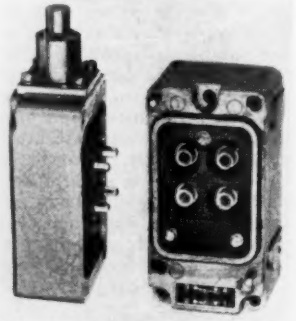
IN fact only about half the size of a thimble is a sub-miniature micro-switch now available weighing as it does only 1/28 oz, and measuring 0·5 in. by 0·35 in. by 0·2 in. This tiny switch is rated 7 A resistive and 4 A inductive for d.c. circuits up to 28 V, or a.c. circuits up to 230 V. It is housed in a plastics case and has single-pole double-throw silver contacts actuated by a snap action beryllium copper spring. Turret terminals are used to give a good wrap round for soldered connections.

For limit-switch applications where failure would mean a serious production hold up, the same company has introduced a plug-in limit switch. A two-circuit double-break switch is used which can be converted to single pole double throw action by a pair of strapping terminals. It is suitable for a.c. ratings up to 10 A at 480 V with reduced rating for d.c. The limit switch and socket are housed in cast aluminium casings and lugs on the casing prevent the switch unit being inserted incorrectly. *Honeywell Controls Ltd., Greenford, Middx.*



Slow-break solid silver contacts operated by a cam are used in the GEC Hidutac switchfuse, giving high breaking capacity and long life. The unit is shown with the protective insulating barrier removed





If a fault develops in this limit switch, it can be replaced simply and quickly by plugging a new unit into the socket on the right. No wiring alterations are necessary

The Ether "Xactrol" potentiometer recorder is particularly suitable for accurate temperature control

for the electrical trade

Small, catchless 'fridge

LATEST "Slimline" refrigerator, the "Junior," a 2 cu ft capacity model and the smallest in the range so far, has a number of special features. Its full width freezer is of lacquered aluminium and has a 21 cube polythene ice-tray. Surface area for direct contact freezing of 3 to 4 lb of frozen food is provided. Perfect sealing of the door without a latch is effected by a powerful magnetic strip around the frame. All shelves, including those on the inner door can be removed for cleaning, and side runners allow the interior shelves to be readjusted to any level.

This model is finished in white stove synthetic enamel and thermally insulated with glass fibre. Polystyrene has been used for the food compartment, door-shelves and freezer tray. "Junior" is available with lilac or clover interior at £50 8s. A compressor type model, it runs on a.c. supplies only; loading about 100W. A plinth which raises the cabinet to 36 in. height may be obtained at £1 15s extra. *English Electric Co. Ltd., Marconi Hse, Strand, W.C.2.*

Fast and slow battery mower

A TWO-SPEED, battery-driven lawn mower will be available in April. It is controlled by two levers on the handle, and an ordinary 3 amp charger will recharge the 12 V battery.

This is a 14 in. mower, with six blades operating at 70 cuts per yd. Drive can be disengaged from the rear wheels, allowing the cutters to function alone in awkward spaces. The slower speed gives the user more control, particularly when cutting down an incline, whilst the faster action provides enough impetus to maintain a comfortable pace when negotiating upward gradients. Once charged, the battery, which is guaranteed for two years, will provide power for cutting an area 40 yd square.

Cost, including the battery, is £58 19s 11d; 3 A charger, £6 9s 6d. *H. C. Webb and Co. Ltd., Tame Rd, Witton, Birmingham 6.*

The Webb two-speed battery mower £59 19s. 11d.

High-wattage fitting

THERE is some danger of flex deterioration through overheating when high wattage lamps in small envelopes are employed for pendant lighting. The Harlequin range of fittings has been modified to eliminate this risk. Now standard on all pendants with p.v.c. flexibles is a special extension to the grip which holds the flex 2 in. away from the lampholder. This obviates the possibility of damage to softened insulation by the clamp grip. *Troughton and Young (Lighting) Ltd., 143 Knightsbridge, S.W.1.*

Battery radio price reductions

REDUCTIONS in prices of some portable battery radios have been announced by GEC. BC 1255 table models and BC 1452 suitcase models have been reduced by £2 12s 6d. They now cost £9 19s 6d.

Time-temperature regulator

AN outdoor-mounted version of the "Thermo-time" regulator for floor-warming installations has been introduced. The external temperature thermostat is housed within the unit to make it completely self-contained. The component described as a regulator in the caption to an illustration on page 342 of our 3 March issue was in fact a new Maclaren ACM-R thermostat, incorporating a circuit switch for compliance with IEE Reg. 314. *R. Maclaren and Co. Ltd., Glasgow C.5.*

Maclaren's "Thermo-time"

Instant dry shaving

ONE of the latest storage battery shavers has a built-in charger. The "Cleanmaster," a rotary action shaver, will operate for a whole week on a single charging. Commercial a.c. supplies from 100 to 250 V will recharge it, no voltage adaptation being necessary; it has simply to be plugged into any socket-outlet and left overnight.

A further advantage is the extra quiet motor which does not drown out the sound of the actual shaving process. Thus when no mirror is available, the user can tell by ear whether the shaver has done its work. Rotary cutting action at 6,000 r.p.m. is provided by four individually sprung blades which sharpen themselves against the back of the comb. "Cleanmaster" weighs 7 oz and is supplied with a leather pouch, guard cap and cleaning brush. Price is £6 19s 9d. *Lonor Ltd., 215-221 Regent St, W.1.*

Large quantity rice-cooker

A NEW rice cooker by GEC steam cooks 50 lb of dry rice in about 90 min. It is designed for use in service camps and other establishments where rice and similar grain foods are prepared in large quantities. Interior lining, basket, lid and water well are of stainless steel. The basket contains two removable divisions giving a choice of up to four cooking sections.

Steam raising is by three 3 kW automatic cutout immersion heaters. Element connections and plumbing fittings are contained in the circular stand which supports the body of the unit. The cooker is 34¼ in. high by 32 in. wide. Maximum loading 9 kW. *General Electric Co. Ltd., Kingsway, W.C.2.*

GEC unit for steam cooking quantities of rice

"WHOLE-AREA" CEILING HEATING

Voleata space heating cables being attached to the ceiling by rivets prior to plastering

THE current high level of interest in floor-warming has tended to overshadow the merits of other surface heating systems which, in the circumstances where they are applicable, could be even more suitable and economic, both as regards material, installation and running costs.

Floor-warming has the merit of storing up heat so enabling current to be switched off during periods of peak demand, thereby qualifying for economic off-peak tariffs. This means that it takes some time to heat up and, conversely, some time to dissipate its stored heat, both factors being a disadvantage in climates like our own where the ambient outdoor temperature may rise or fall by ten degrees or more in a matter of hours. For the best performance, floor heating systems should be planned and incorporated in the building during its construction.

Ceiling heating can be installed in existing rooms with little structural derangement, an important consideration in many cases and a vital factor in cost. The cables are attached to a backing of plasterboard with wire rivets applied by a tacking machine and are covered to a depth of approximately ¾ in. with gypsum plaster. The cables are identical with those used in floor-warming and the overall cost is about 25% lower.

Because ceiling-warming has only small storage capacity it does not qualify for off-peak tariffs but it is far quicker to respond to the requirements of rapidly changing ambients and can be operated at slightly higher surface temperatures, a recommended maximum being 90° F as against 75° F for floors. The running costs are somewhat less even allowing for the difference in tariff.

Volex Electrical Products Ltd., of Salford, makers of embedded heating cables for all forms of surface heating and with wide experience of the different systems, floor, wall and ceiling, have just issued a technical note on their Voleata "Whole-Area" ceiling heating system (Ref. VAF/RT/DS6) giving some useful information on the subject of ceiling heating in general which should be read by all who are concerned with the planning and installation of surface heating equipment.

The Malayan market

ALWAYS regarded as a good market for British domestic electrical appliances, Malaya is now importing many items from Japan, Germany, Italy, Hong Kong and India. Even so, UK manufacturers supplied over half the total imports of just under £2 million in 1958—about half of that share being for domestic refrigerators alone. Even in the latter sphere, Germany and Japan are getting a growing share of a rapidly expanding market, according to a recent market report prepared by the UK Trade Commissioner in Singapore. He emphasises that it is a keenly competitive market where strong advertising support is necessary, and much of the equipment is sold on eye appeal. Local taste prefers chrome-plated to coloured irons, for instance, and the heavier these are, the better it seems (7 lb is the favourite weight).

Increased competition is also feared in the cooker sphere where British models have enjoyed a large trade. An Italian model with glass doors, but without a grill plate, has appeared at a competitive price and is stated to be selling quite well. There is also good demand for toasters, mostly of the automatic type, but there is a Japanese polished aluminium non-automatic model selling at a comparatively low price.

In the washing machine trade, where the UK have had almost a monopoly, there is growing competition from Japan particularly in the cheaper and simple type with hand wringer, and it is in this section that the market is expected to expand. It is also anticipated that sales of drying cabinets could increase in view of the growing numbers of flats now being erected in the principal towns.

Competition is keen in the fan trade, where the UK is still the main supplier of the ceiling type, with India the chief competitor. But the expanding market for table fans is virtually dominated by Japanese firms who are supplying types in pastel shades, finishes which seem to be preferred to the comparatively staid style of those from manufacturers in the UK and other European countries. Those from Japan also include a close-mesh guard—a further refinement—in addition to being oscillating, while some have an adjustable telescopic stand.

Refrigerator market

The best market would seem to be for refrigerators, where the UK already takes a major share, but new models are appearing from Germany, Japan and Italy, and British firms need to be very active to combat this invasion. The most popular size is in the 6-8 cu ft range, but quality of the finish and fittings is important. The market for vacuum cleaners and floor polishers is also steadily increasing with the continuous improvement in economic conditions, and here again, the cheaper Japanese competition is making inroads into what has largely been a market for UK firms. In addition there are machines from Sweden and Holland which are taking an increasing share of trade. For the smaller appliances, such as electric shavers, hairdryers, and food mixers, there is as yet only a small demand, it is stated.

It is stressed that almost all domestic appliances are imported by sole agents who normally allow discounts of 20-25% to traders. There are no import restrictions, and for Singapore and Penang there are no import duties. In Malaya 15% *ad valorem* duty applies, while for Sarawak the preference rate is 10% and for Brunei 5%.

There are plans for local manufacture in Malaya of certain appliances under the Federation's Pioneer Industry Legislation which applies particularly to air-conditioners, fans, domestic refrigerators, and washing machines, but, at the moment, there is no local manufacture. There remains a good market for many types of appliances, but British manufacturers are reminded that local publicity support is essential, even to the provision of adequate literature and display material.

News of the Week

NEW BULK SUPPLY TARIFF TO ENCOURAGE INTERRUPTIBLE LOADS

Standard Charges remain Unchanged

CHEAPER peak kilowatts for industrials who are willing to reduce their electricity demand when called upon to do so are a feature of the CEGB bulk supply tariff for supply to area boards during 1960-61.

Adjustments of the form of tariff to make such arrangements practicable for the boards is the only change of importance in the tariff; otherwise it is unaltered from that applying to the current year.

The normal kilowatt charge remains at £7 2s on the basis of half hour m.d. between 7 a.m. and 7 p.m. on weekdays, and 7 a.m. and 12 noon on Saturdays; and a running charge of 0·41d/kWh subject to fuel cost adjustment of 0·00055d for each penny by which the cost of coal (adjusted to 11,000 B.Th.U./lb) varies from 60s/ton. The arrangements for taking account of imports of electricity into an area when calculating fuel costs continue as before.

The bulk supply tariff is necessarily worded in terms of direct supply from the CEGB to an area board; but for the special interruptible load terms to apply, a consumer must be directly connected to a power station or substation of the CEGB, and he must be imposing a demand which can be cut by at least 25 MW on instruction from the CEGB—and reduced by that amount within five minutes of the instruction.

It is also required that the consumer shall agree to his demand being restricted for up to two hours in any one occasion, subject to an aggregate time of restriction of 50 hours in a year.

Where the interruptible load tariff is to apply to a consumer, there will have to be a three-way agreement between consumer, area board and CEGB. This agreement will state a figure for "nominated firm kilowatts" (which must be at least 25 MW below the normal half-hour m.d.); and this is the figure to which the consumer may be asked by the CEGB to cut his demand.

For the nominated firm kilowatts, the area board will have to pay the usual £7 2s, but for any excess demand of the consumer during normal peak hours, but outside the period during which the CEGB may have exercised their option to impose a restriction, they will pay only £3 3s; a saving of £3 19s/kW.

There is naturally a penalty clause; the full kW m.d. charge is to apply on a basis of a five minute integrating period for any excess demand above the nominated firm kilowatts in any period when restrictions are in force (other than the first five minutes after the instruction to cut has been given).

The notional m.d. on the CEGB, used in computing m.d. charges to area boards is set at 24,000 MW in the new tariff, and is now related to a formula which takes account of the new arrangements for interruptible loads. Steel works and some kinds of electrochemical works are likely to be prominent among industrial consumers to whom the new arrangements will bring advantage.

Major new retail outlet for appliances

Singer's (450 shops) latest move

ANOTHER major chain of shops throughout the country is to sell domestic electrical appliances. That is the likely result of the latest decision by Singer Sewing Machines Ltd., who own about 450 shops. Under the banner of "a new service for housewives" the firm has just started displaying the Parnall vacuum cleaner in their shops, initially in the southern part of the country. Also, as an experiment, four selected shops of the company, in Birmingham, Bradford, Nottingham and Trowbridge, the complete range of appliances of the Electrical Division of Radiation Ltd., including washing machines, vacuum cleaners and refrigerators, is being handled, in addition to the firm's own sewing machines.

To run this new venture, Singer have formed a new Development Division, with Mr E. Playle as its sales manager, and the results will decide whether the firm's other shops are to undergo similar treatment.

It should also be remembered that when calling at people's homes on normal sewing machine maintenance work, Singer's representatives will have ideal opportunity to interest potential customers in these other appliances.

This is not Singer's first venture into this sphere, for, apart from the electric iron marketed under their own name in recent years, they supplied a vacuum cleaner before the war.

Direct sales expansion

THE Rolls Electromatic company, well known for their direct sales washing machine trade, are planning to extend still further. A new 4·7 cu ft compressor type refrigerator selling at 47 gn is being launched, to be followed later by a dishwasher and other domestic appliances. Mr J. Bloom, who founded the Electromatic business, has now become managing director of the new concern.

Power Station Plan shocks Council

THE CEGB's selection of suitable sites for new power stations in Notts (which we reported last week) has produced shocked reactions from Nottinghamshire County Council. Of the four projected stations, the two to be sited at Holme Pierrepont and Ratcliffe are the subject of protest.

In a statement isued last week, the chairman of the planning committe said that while there seemed to be no serious objection to the proposed sites at West Burton and Cottam, they had made it clear that they would have the strongest objection on planning grounds to any proposals to establish power stations amid the "considerable rural amenities" of Holme Pierrepont and Ratliffe on Soar.

. . . but pleases Coal Board

The National Coal Board, however, state that they are "very pleased" about the CEGB's new sites, and welcome the prospect of supplying five million tons of coal a year to each of the two projected power stations. This represents a gratifying rise in demand from an industry which already consumes 46 million tons of coal a year, and illustrates "the close co-operation existing between coal and electricity."

Lucas link with Collins

A NEW company named LCE Ltd. has been formed jointly by Joseph Lucas Industries Ltd. and Collins Radio Co. Ltd. with a nominal capital of £100,000, to engage in electrical, electronic and mechanical engineering. Lucas are to issue a statement in the near future.

I.E.E. meetings to study Electronic Equipment

TWO specially arranged meetings to consider electronic equipment have been decided on by the Institution of Electrical Engineers. One is a symposium on electronic equipment reliability, to be held on 18 May next; the other, a five-day conference on components and materials used in electronic engineering, which is being scheduled for 12 to 17 June, 1961.

The symposium arranged for next May will be concerned with field experience and methods of assessing and predicting reliability of components, and will take place in three sessions at Savoy Pl, composing a whole-day meeting. The intention is to provide an opportunity for exchanging information on all aspects of electronic reliability.

Further details concerning the programme for the meeting are to be released later, but it is already known that anyone wishing to attend will be required to register. The necessary forms may be obtained from the secretary of the IEE, Savoy Pl, W.C.2.

With respect to next year's conference on components and materials, the Institution is inviting submission of papers suitable for presentation at it. The conference will fall under three main headings:

Materials. Preparation and physical properties, and their applications to modern components. Constructional materials, such as boards for printed wiring circuits, soldering and encapsulating materials.

Components. Fixed and variable resistors, potentiometers, capacitors and inductors, transformers, transductors, switches, relays, plugs, sockets and contacts. Small motors and synchros. Equipment wiring, r.f. connecting cabling and fuses. Potted and printed circuit components and modular structures. (Emphasis is to be placed on new techniques of measurement and the effects of extreme operating conditions.)

Assembly techniques. Miniaturisation. Methods of automatic assembly. Wrapped and crimped connections.

The conference will *not* cover thermionic devices, transistors and other semiconductor devices, neither will applications be included, except incidently.

The institution has also stated that another step has been taken with the International Conference on Medical Electronics, to be held at Olympia from 21 to 27 July this year. National co-ordinators have been appointed in 23 overseas countries.

Electronics Industry Council Formed

AN Electronics Industry Council has been formed, with offices at 11 Green St, W.1, to represent the interests of associations or federations of manufacturers in the UK concerned with electronic components, apparatus and equipment (except that used in broadcasting and the telephone service). The new council will aim to promote the electronics industry, and liaise with the Government and other industrial and commercial bodies in the United Kingdom.

B.E.P.C. 1961

THE 1961 British Electrical Power Convention will be held at Eastbourne from 12 to 15 June next year, under the presidency of Sir John Pickles, B.Sc., M.I.E.E.

TAKEOVER NEWS

Winston

THE Shepperton firm of Winston Electronics has been acquired by Dynamics Corpn., of America, for 9,800 Common stock units in DCA plus a cash sum.

Goblin

THE company recently acquired by Goblin (BVC), to which we referred on 3 March, is W. and S. Summerscales Ltd., of Keighley, who already supply a small washer machine in addition to other household goods. The firm's products will continue to be marketed under the present trade name.

Simon

ELECTRIC and Musical Industries Ltd. have now withdrawn their offer for the capital of Henry Simon (Holdings) which we reported last week. Complete merger of the latter concern with Simon-Carves Ltd. is now recommended by the two boards.

Bird

GAS Purification and Chemical Co. have withdrawn their offer to shareholders of Sydney S. Bird and Sons Ltd. noted in our 3 March issue.

Appliance deliveries: level maintained

THE high level of manufacturers' deliveries of domestic electrical appliances established earlier in 1959 was maintained during the last three months of the year, according to the latest BEAMA quarterly survey, in which figures for electric refrigerators, spin and tumbler dryers, food mixers and dishwashers appear for the first time, in addition to other domestic appliances.

Total deliveries (excluding refrigerators) reached £33½ million for the home market and just over £3 million for export, the figures for the previous quarter being £28½ million and £2·9 million respectively. The most notable gain was achieved by spin dryers, which were 58% up on the previous three months. Other increases worthy of note were in combined washing machines and spin dryers (nearly 20% up) and cookers over 5 kW (almost 30% higher). A full analysis of appliance deliveries for home and export is given in the table (left).

Manufacturers' Deliveries of Domestic Electrical Appliances for the three months ended 31 December, 1959

Appliance	Home Market		For Export	
	Thousands	Value £000s	Thousands	Value £000s
Electric blankets	445	1,149	1·8	4·2
Cookers, domestic:				
(a) below 5 kW	25	280	1·4	12·8
(b) 5/12 kW	130	4,621	4·5	125·1
Dishwashers	2	158	0·7	32·6
Drying cabinets	17	111	0·03	0·3
Floor polishers and scrubbers	6	90	18·4	161·5
Hand hair dryers	221	401	11·0	19·7
Irons (a) non-automatic	51	35	9·3	7·0
(b) automatic	497	884	117·6	264·8
Dry shavers	451	1,862	n.a.	n.a.
Space heaters (up to 3 kW)	970	3,481	24·2	92·1
Spin dryers	93	1,673	12·2	168·4
Heated tumbler dryers	15	450	0·9	27·2
Toasters	62	180	22·6	71·8
Food and drink mixers up to 3 qts. (inc. hand held)	40	498	15·1	219·0
Elec. refrigerators	125	n.a.	15·4	n.a.
Vacuum cleaners	359	4,873	48·0	454·6
Elec. washing machines, inc.				
(a) hand or power wringers	156	5,758	20·5	528·5
(b) combined spin dryer	113	6,058	27·7	892·3
Water heaters:				
(a) immersion (up to 3 kW)	135	195	8·6	11·5
(b) storage (up to 30 gall.)	37	381	3·6	49·3
Washboilers (up to 10 gall.)	61	437	0·7	5·1
Total value (excluding 'fridges)	£33,575,000		£3,147,800	

Note: n.a. = figures not available.

Semi-conductor Course

A THREE-DAY full-time course on semiconductors is to be held at the Portsmouth College of Technology on 26, 27 and 28 May next. The lectures covering transistor techniques, switching, silicon controlled rectifiers and parametric amplifier diodes, will be given by a member of the staff of GEC's research laboratories. Full details are available from the head of Electrical Engineering Dept. at the College.

Industry buys more power

MOST notable feature of the Electricity Council's latest quarterly return of electricity sales to consumers during the three months ended 31 Dec., 1959, is the large increase in the amount taken by industry, nearly 11,500 million units and some 12½% more than in the same period of 1958. With the exception of farms, all types of consumer used more electricity during the quarter. During 1959 as a whole, sales to all consumers were up on 1958, the average gain being 8%. It should be remembered that the figures contained in the table above refer to units metered or billed during the period concerned.

Electricity sales to Consumers in millions of units

Type of Consumer	3 months ended		12 months ended	
	31 Dec. 1959	% change over last year	31 Dec. 1959	% change over last year
Domestic ...	5,940·9	+ 7·4	25,990·7	+ 8·0
Farm ...	332·8	− 8·7	1,495·8	+ 4·3
Commercial	2,513·3	+ 4·5	10,188·4	+ 5·3
Combined Domestic/ Commercial	310·1	+ 6·7	1,341·7	+ 7·4
Industrial ...	11,422·9	+ 12·6	41,376·3	+ 9·1
Public Lighting ...	224·7	+ 7·8	711·9	+ 7·5
Traction ...	400·1	+ 2·6	1,529·5	+ 0·2
Total ...	21,144·8	+ 9·4	82,634·3	+ 8·0

Engineering Pay Claims?

A NEW wage claim in the engineering industry seems imminent. The executive council of the Confederation of Shipbuilding and Engineering Unions last week decided to recommend to the annual conference in June that an application be made for a general wage increase in the industries. A reduction of two hours in the working week—to 42 hours—is to operate from 28 March.

N.Z. relaxes imports

IMPORT relaxations affecting some 300 items were announced last week by the New Zealand Government. The relaxations apply to a wide range of consumer goods, among which are listed, electric motors, electric shavers and scientific instruments. Value of the increased imports is estimated at £15 to £20 million.

Latina staff train at Calder Hall

ITALIAN engineering staff who will hold key posts at Latina nuclear power station are being given an intensive training course at Calder Hall. The course includes a period at Calder Operations School and a period of attachment doing practical work on the Calder plant itself. Length of training varies according to the status and nature of engineer's function at Latina, varying from three to 11 months. At present there are 13 (but soon 17) Italian staff taking the course.

These special facilities have also been afforded for some time to the staff of the CEGB and the S of S EB to prepare them for running the projected power station reactors as they come into operation.

Latina is to be a 200 MW single reactor and is being built by the Nuclear Power Plant Co. of Britain in conjunction with the Italian concern Agip Nucleare. Similar training facilities are likely to be arranged for Japanese engineers in connection with the 150 MW reactor to be constructed by GEC at Tokai Mura in Japan.

The training course is expected to be of interest to other overseas organisations contemplating the purchase of a British Calder-type power station.

Fridges in the News

SELLING . . .

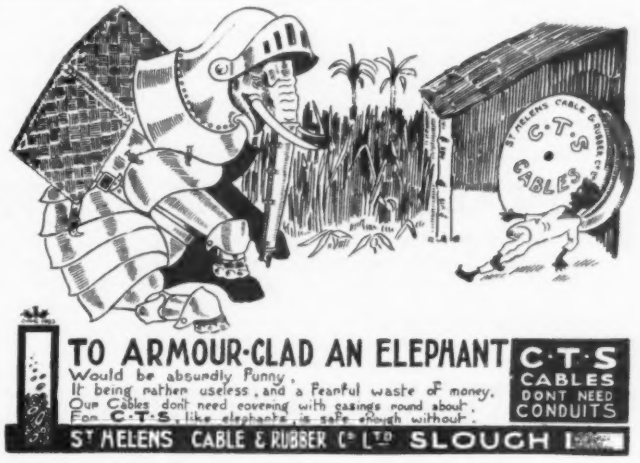
HOME market sales of domestic refrigerators in January totalled 80,685, compared with 44,918 for Jan., 1959, an increase of 82%, according to the Domestic Refrigerator Development Committee. Export sales during the month also increased from 6,263 (Jan., 1959) to 6,852.

These figures continue the upward trend characteristic of recent years. Home sales of refrigerators during 1959 were almost 100% up on 1958, the previous record year, and 230% higher than in 1957.

. . . SHOWING

THE Second Refrigeration and Air-Conditioning Exhibition will be held at Earls Court, from 11 to 14 April, 1961. This year the show will be expanded to cover domestic models in addition to commercial and industrial equipment. At the same time, a Refrigeration Convention will be held, divided into technical and commercial sections. More than 80% of the stand space at the exhibition has already been booked.

Older readers of the E.T. may recollect this reproduction—one of a series of advertisements by St. Helens Cable and Rubber Co. in the 1920's—in which humour was used to draw attention to the advantage of cab-tyre sheathed cables.


TO ARMOUR-CLAD AN ELEPHANT
Would be absurdly Funny,
It being rather useless, and a Fearful waste of money,
Our Cables don't need covering with casings round about,
For C·T·S, like elephants, is safe enough without.
C·T·S CABLES DONT NEED CONDUITS
ST HELENS CABLE & RUBBER Co LTD SLOUGH
C·T·S CABLES

END OF A PIONEER CABLE NAME

ONE of the oldest names in the cable industry, St. Helens Cable and Rubber Co. Ltd., is to fade from active life on 1 June next when its manufacturing and marketing activities will be integrated with those of BICC. This is part of BICC's policy of concentration under the existing competitive conditions and excess manufacturing capacity in the industry.

Supplies to customers of the St. Helens company will be safeguarded, BICC state, and the integration will result in an even higher standard of service. Cable manufacture will be transferred progressively from the Slough factory to other factories in the BICC group, and selling activities will be combined with those of BICC. The St. Helens business in mechanical rubber products will, however, continue as at present until further notice. St. Helens staff will be absorbed as far as possible within the BICC group, and those who cannot be so employed will be paid compensation and given aid to find alternative posts.

The St. Helens Cable and Rubber Co. was established in 1906, and became famous as the inventors of the CTS cables. It became a member of the BICC group in 1945. There must be many in the industry who will view with regret the passing of another famous name.

OFFICIAL PUBLICATIONS

North of Scotland H.E. Board. Report for 1959. HMSO, 5s 6d (see page 412).

South of Scotland Electricity Board. Report for 1959. HMSO, 4s 6d (see page 413).

BS 2G.100. General Requirements for Aircraft Electrical Equipment. Part 3. Characteristics of Electrical Power Systems and Equipment. 6s.

BS 1270. Schedule for Electric Discharge Lamps for General Purposes. 5s.

BS. 3155. American Machine Screws and Nuts below ¼ in. dia. 8s 6d.

Reinforcement Problems in Sheffield

DIFFICULTIES encountered in reinforcing and standardising electricity supplies in Sheffield, where 5,400 out of 198,000 consumers have substandard voltage during peak periods, were outlined by the Parliamentary Secretary to the Minister of Power in the House of Commons last week. To deal with the problem the Yorkshire Electricity Board has 37 reinforcement schemes in hand which will take care of 4,800 consumers, and the position of the remaining 600 is being studied.

The board is often hampered in its plans by the difficulty of finding suitable sites for substations in built-up areas, and delay can be caused by the need to wait until the local authority had drawn up its plans for the development of the area.

In the Fellbrig Rd locality of Sheffield, for example, where the voltage is below the statutory minimum, the YEB decided that three additional substations were needed for reinforcement, and started seeking sites for them in 1957. Permission was finally obtained for the first substation in May, 1959, and for the other two last December. Work is now in progress and the new substations will be in use well before next winter.

Spending on reinforcement in England and Wales was £32 million in 1956-7, £37 million in 1957-8, £39 million in 1958-9; and the estimate for 1959-60 is £46 million.

Oldbury: Public Inquiry

THE Minister of Power has decided to hold a public inquiry into the proposal by the CEGB to build a nuclear power station at Oldbury, Glos. The inquiry will be held at Cossham Hall, Chapel St, Thornbury, Glos, at 10.30 a.m., on 12 April next, and subsequent days if necessary.

Mr A. H. F. Linton, deputy chief engineering inspector of the Ministry of Power and Mr C. D. Buchanan, principal planning inspector, Ministry of Housing and Local Government, have been appointed to hold the inquiry.

Oldbury nuclear power station is expected to have an output of about 1,000 MW, connected to the 275 kV supergrid. Sited on the Severn, it would take advantage of a rock shelf off-shore to create an artificial tidal reservoir from which the large quantities of cooling water needed could be drawn during low tide periods.

Auto-control Congress

TWENTY-EIGHT papers have been selected to form the British contribution on the subject of automatic control for presentation at the first International Congress on Automatic Control in Moscow, from 27 June to 7 July, 1960. Total number of papers to be presented is 282, and 20 countries are represented. The congress will be organised by the USSR National Committee for Automatic Control under the International Federation of Automatic Control.

Inquiry into E.T.U.?

A DECISION as to whether there is to be an inquiry into allegations of electoral malpractices against officials of the Electrical Trades Union may be made at next Monday's meeting of the TUC Finance and General Purposes Committee. When the latter interviewed Mr F. Foulkes, ETU president, and Mr F. Haxell, general secretary, on the matter last Monday, the latter indicated that they would not be averse to an inquiry provided it was made by an impartial person within the trade union movement.

The Need for Collaboration

THE size of an engineering institution can sometimes pose problems, H. Desmond-Carter, president of the Institution of Mechanical Engineers, said at the IEE's N.W. Centre annual dinner in Manchester last week. A bigger body had of necessity higher standards; as a result the high technical quality of the papers could only really be understood by a minority of members. This could result in a feeling of remoteness from the institution.

"We at the Institution of Mechanical Engineers are 'independence minded'," he added. "There are no serious disadvantages in the present system, but we are also very keen on collaboration with sister institutions."

This thought was echoed by Sir Willis Jackson, who stressed that the three engineering institutions had an important part to play in technological development, and their collaboration was necessary for the pursuit of science as a whole. Most electrical problems were based on mechanical difficulties, and here collaboration had played an important part.

BRUSSELS FAIR 1960

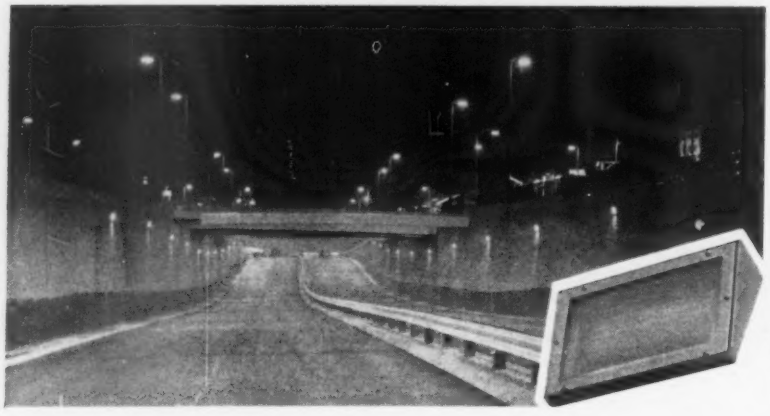
THE thirty-third Brussels International Fair will be held from 30 April to 11 May next at the Grands Palais du Centenaire, Brussels, with more exhibitors than ever. Layout of the Fair will be similar to that of 1959, with the addition of a new industrial equipment group. The 1,000 page official catalogue will be published in April.

PLASTICS SALES RECORD

SALES of plastics materials in 1959 reached 501,000 tons, a 20% increase over the year before. Exports, too, were a record at 146,000 tons, almost 28% higher than in 1958. At the same time imports also increased sharply, and at 54,000 tons were 32% up on the previous year, due largely to an increase of 9,000 tons in shipments from the USA.

Main gain was in sales of thermoplastics (up 25%), while thermosetting materials increased by 13%. The largest thermoplastics increase was in the sales of polyethylene which were 44% higher than in 1958, but sizeable gains were also recorded by polyvinyl chloride, polystyrene and acrylics. In the thermosetting group expansion was evenly distributed over the various types, with polyesters and epoxide resins showing rapid advances.

The figures were compiled by the Board of Trade from returns from over 160 firms, excluding cable manufacturers who make plastics materials from purchased resins and discounting materials for use as textiles.



To light the new Hook under-pass on the Portsmouth Road, sodium lighting from columns mounted on the adjacent higher level feeder roads is supplemented by a series of 20 semi-recessed wall fittings mounted under the bridges to provide an even level of illumination. The fittings contain 60 W lamps behind diffusers with refractor plates, and were specially designed by AEI Lamp and Lighting Co. in collaboration with the Surrey County Council. Picture shows the under-pass at night with (inset) a close-up of one of the wall fittings

S. Scotland completes Rural Electrification

WITH 93% of all farms in South Scotland now supplied or being connected, the South of Scotland Electricity Board announce completion of their planned rural electrification programme. In 1948 only 5,310 farms had a public supply in the area and in the past 11 years 9,178 farms have been connected. £7·3 million being spent in developing rural areas in that period.

But the problem of insufficient revenue from such consumers remains. Average annual consumption per farm for 1959 was 9,675 units, compared with 4,902 in 1949. Although this is an increase of almost 100%, last year's figure is still below an economic level, but the Board are actively encouraging farms in the greater use of electricity.

Retail Sales in January

SALES of electrical and radio goods by independent retailers showed only a small increase of 1% in January, compared with the same month last year. Department stores, on the other hand, sold 11% more electrical and radio products, according to the latest Board of Trade figures.

Electrical Exports slowed in 1959

ALTHOUGH in engineering generally the UK's export performance in 1959 was better than average for most countries, electrical equipment exports increased at a slower rate than the average for all manufacturing countries. In contrast, Germany recorded a big gain, while Japan's exports were almost double those of the year before.

Among other major competitors in this field, exports from France and the Netherlands were up, but the USA's figure was lower than in the first half of 1958.

Heavy electrical equipment—generators, transformers, etc.—suffered most so far as UK exports were concerned, being lower than a year earlier and at about the same level as in the first half of 1957, but exports of other electrical apparatus and appliances were markedly higher. Apart from Germany and Japan, most other countries followed the same general export pattern as the UK. The following tables show actual export figures in US million dollars, with percentage change in brackets.

M.I. CHIEF ON TOUR

Sir Charles Westlake, chairman of Metal Industries which recently acquired the Lancashire Dynamo group, is now on a round of visits to his new companies. He is pictured here (centre) at a reception in London attended by engineers from the 11 branch offices of Foster Transformers. Left to right: S. A. Hunter (Foster sales manager), S. C. Brown (Foster works director), W. Padley (MI director), Sir Charles, R. V. Ely (Foster executive director) and W. J. Lovie (Foster contracts manager)

Future plans for Gas

AT the planning stage of any major gas-making project, the Gas Council would consult with the National Coal Board to consider the possibilities of basing the scheme on coal, the Minister of Power stated in the House of Commons last week during the second reading of the Gas Bill. Production of gas would continue to be based largely on coal, so that various schemes for developing the gas supply industry would also benefit the coal industry.

The purpose of the Bill is to increase the borrowing limit for the gas industry's capital requirements and fixed investments from £450 million to £525 million. Some of the schemes on which the money is to be spent include:

Lurgi process: two Lurgi gas plants are being built, one at Westfield, Fife, and the other at Coleshill, near Birmingham. This produces gas under pressure from poor quality coal, but costs are high, and economic working requires very large plants.

National grid: the possibility of establishing a national grid to transmit gas by high-pressure pipelines is being considered. To cut costs the gas supply will be based in the coalfield, from where gas will be piped into the grid.

Underground storage: there is some difficulty in finding suitable natural rock formations. One cavity in rock salt has been located at a depth of 1,300 ft, capable of storing 10 million cu ft of gas at a pressure of 440 lb sq in., and other possible sites are being investigated in Hampshire, Kent and Scotland.

Natural gas: although natural gas has been found in Yorkshire and will be used by the NE Gas Board in due course, there seems little prospect of finding further supplies in substantial quantities.

The Minister said that the proposed developments would increase the competitive power of the gas industry and, by reducing costs, would improve the earning power of the industry which last year had shown a loss for the first time.

Sizewell Responsibility

RESPONSIBILITY for construction of the CEGB's Sizewell nuclear power station, Suffolk, is to be with the board's Midlands Project Group. This 650 MW station is to be built on a 245 acre site two miles east of Leiston. The Midlands Project Group is shortly to move to new offices at 341 Bournville La, Birmingham 30.

Year	UK	W. Germany	Belgium-Luxembourg	France	Italy & Trieste	Netherlands	Sweden	Switzerland	USA	Canada	Japan	Total
1954 ...	476	367	63	129	39	158	62	73	540	36	23	1,976
1955 ...	537	449	86	150	45	182	62	76	582	32	31	2,231
1956 ...	608	543	98	137	43	185	74	83	695	34	51	2,549
1957 ...	636	642	102	163	51	190	79	86	745	37	78	2,811
1958 ...	626	668	114	200	62	226	86	91	735	37	99	2,944
Jan. to June 1958	311	302	57	95	30	108	42	44	354	17	40	1,401
Jan. to June 1959	326	360	49	96	25	129	41	45	343	20	74	1,509

Equipment	UK	West Germany	OEEC "Six"	USA	Canada	Japan	Total
Generators and alternators, motors and converts, transformers and switchgear ...	96 (—3)	83 (+6)	72 (—7)	100 (—13)	5 (+56)	9 (+147)	365 (—3)
Other electric machinery, apparatus and appliances	230 (+9)	277 (+24)	313 (+5)	243 (+1)	15 (+7)	65 (+81)	1,144 (+12)

ABOVE: Exports of electrical equipment, apparatus and appliances in US $ million from 1954 to 1959

LEFT: Exports of electrical equipment in US $ Jan.-June 1959 and % change over Jan.-June 1958

SUN SHOWROOM

Smart showrooms in Sun Electrical Co.'s new Leeds branch. Lighting fittings are supported from trunking in the suspended ceiling by means of a special double-hook and tube device which gives immediate access whilst maintaining neat appearance

Sun at Leeds has new look

AFTER 37 years at their Park Place premises, the Leeds branch of the Sun Electrical Co. recently moved to a brand new building off Whitehall Rd, where a one-acre site provides greater room for customers' van parking as well as improving access for their own van delivery service. The new premises comprise a single-storey rear section for storage and garaging fronted by a double-storey block which houses a 40 ft trade counter on the ground floor with offices and showrooms above.

The main feature, of course, is the 2,300 ft showroom areas which have been designed to display in appropriate settings a wide range of period, modern and contemporary lighting fittings, together with domestic appliances and heating equipment. The showroom ceilings are constructed in a Dexion grid system (as at the Charing Cross Rd premises) in which some 500 ft of trunking has been fitted, carrying special suspension units and pull switches.

Supply Electricians' Pay Row

About 300 contracting electricians employed around Liverpool by the Merseyside and North Wales Electricity Board want to continue on a 44-hour week—but with the new 42-hour rate of pay. Threatened strike action was called off and they returned to work last Thursday to allow discussions at national level.

The men, a minority, had always operated under the N.F.E.A. agreement, but, some months ago, in an endeavour to bring them all under the N.J.I.C. agreement, the Board, with E.T.U. approval, offered as an interim measure to pay according to the NJIC agreement. A reduction of the working week to 42 hours without loss of pay, took effect on 1 Feb. but the E.T.U. have rejected the offer of the reduced working week at an increased hourly rate, claiming that these men should have the increased rate for a 44-hour week. The NJIC may consider the matter today.

U.K. Export Prices Too Low?

THE UK's share of world exports in heavy electrical engineering was only being maintained because we were quoting prices which were inadequate to cover our overheads, Sir John Woods, a director of English Electric and former Permanent Secretary to the Board of Trade, told 150 members and guests at the Electrical Industries' Club luncheon last week. Other countries were undercutting us; for example, German quotations were 25% below ours.

"A state of world over-capacity in heavy electrical engineering has emerged," he said. "With the advent of the Common Market, competition will become more keen."

Commenting that too many firms tended to rely on Imperial Preference, which he thought was a wasting asset, Sir John stressed the need for closer co-operation between the large British electrical manufacturers, particularly in the export market.

The next meeting of the club will take place on 12 April, when the guest speaker will be Lord Mancroft.

Capacitor Show

AN exhibition of power factor correction capacitors and associated equipment is to be held in Liverpool from 26 to 29 April. The display, organised by Standard Telephones and Cables in association with Manweb will be open at the Manweb Electrical and Industrial Development Centre, 83 Paradise St, Liverpool 1, from 10 a.m. to 5 p.m. each day.

Market for Electric Hoists

MANUALLY operated pulley blocks still predominate over electric hoist blocks for use with loads from one to ten tons. That is the conclusion to be drawn from a survey carried out recently in South Wales by Brunnings Marketing Services Ltd. The results of interviews with 52 firms in manufacturing industry in the area showed how many were lagging behind in handling speed when the use of the electric hoist would increase their efficiency.

One of the most common advantages stated for the electric hoist was "quicker turn-round of transport." This opinion is borne out by the survey in the table below, which shows that a greater percentage of blocks used for loading and unloading are electrically operated. The same applies to their use during manufacturing processes.

Frequency of use	Loading Unloading and Dispatch		During or part of the Manufacturing Process		Maintenance		Initial Erection or Machine Assembly Duties		No Purpose Stated	
Type of block	M	E	M	E	M	E	M	E	M	E
No. of blocks in use	90	41	114	62	236	2b	11	—	6	2
Hourly	9%	64%	56%	79%	—	34%	*	—	*	*
Daily	12%	34%	17%	16%	43%	38%	*	—	*	*
Weekly	11%	—	10%	5%	8%	8%	*	—	*	*
Monthly	11%	2%	3%	—	11%	—	*	—	*	*
Infrequently	57%	—	14%	—	38%	20%	*	—	*	*

Table showing comparative industrial use of mechanical and electrical hoists in the area surveyed. M=Mechanical; E=Electrical; asterisks indicate too small a figure to show as a percentage

Of the users of electric hoists, 91% employed them on an hourly or daily cycle whereas only 43% of hand pulley block owners used theirs at the same frequency. On the other hand, the survey report points out, three-quarters of the manual blocks used during a manufacturing process were employed at hourly or daily intervals. Obviously, great room for improvement lies here, where the electric hoist can be utilised to its best advantage.

The Brunnings report on this survey does not claim to outline an omnipresent situation, nor does it predict the extinction of hand pulley blocks. It clearly shows, however, that in a typical industrial area of the UK mechanical handling is in need of a shot in the arm.

Board appliance sales static

SALES of domestic appliances by electricity boards in England and Wales in January showed no great change on the figures for December, 1959, allowing for the usual post-Christmas falling off in sales, which mainly affected cookers and refrigerators. Both of these, however, were up on January, 1959, and

Type of Appliance	Sales in month ended		Sales in 12 months ended	
	31 Jan. 1960	% change over Jan. 1959	31 Jan. 1960	% change over previous year
Cookers ...	23,775	+ 6·4	338,374	+25·3
Water Heaters:				
Immersion	7,898	+ 9·3	190,411	+15·4
Storage ...	4,886	+ 8·6	60,935	+20·6
Washboilers	4,769	−18·5	66,094	−17·7
Washing machines ...	12,713	−20·3	160,803	+ 40·9
Refrigerators	4,341	+14·0	165,963	+113·5

taking the whole of 1959 into account both made considerable gains on the year before, refrigerators, totalling 165,963, achieving a sales increase of nearly 114%. Although washing machines showed a small increase on December, 1959 (12,713 compared with 12,352), they were 20% down on January, 1959; over the year, however, sales were 40% higher.

It should be remembered that the figures relate only to area electricity boards in England and Wales, whose sales represent only a part of the total for the country.

S.I.M.A. in Moscow

THIRTY-FOUR British scientific instrument manufacturers are to show and demonstrate their latest equipment at an exhibition to be held at the Polytechnic Museum in Moscow from 18 June to 29 July. Organised by SIMA, the show is believed to be the first of its kind to be held in USSR.

Sayings OF THE WEEK

"This Board takes every conceivable step to safeguard the amenity of the countryside, but I think there are some people who are inclined to rate that higher than the benefits to be derived from the use of electricity by human beings whom we want to continue to live in the North of Scotland." . . . LORD STRATHCLYDE, chairman, N. of Scotland HE Board.

"Electric fires with the element encased in heavy iron grilles and borne on Queen Anne legs are as happy an alliance as a sporran worn with a top hat and frock coat." . . . MR D. KEIR, of N. of Scotland HEB at EDA Sales Conference.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, March 15

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	248	−3
,, (3 months)	235	−1
LEAD, refined pig, 99·97% purity (cash)	76½	+1
,, (3 months)	75½	+½
TIN, refined, min. 99·75% purity (settlement)	792	+8½
(3 months)	790½	+7
ALUMINIUM, ingots 99·99·5% ...	186	—
,, wire bars (4×4×54")	209	—
BRASS Strip 63/37	214	−7½
SILVER (Troy oz)	79½d	—
ZINC, virgin, min. 98% purity (cash)	83½	+½
,, (3 months)...	87½	+½
RUBBER, per lb.		
No. 1, R.S.S. spot	34d	−⅛d
c.i.f. basis, ports, May	34⅛d	+⅛d
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 × 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	70½	—
AMERICAN PRICES:		
Copper, electrolytic (per lb) ...	33c	−2c
Lead (New York)	12c	—

* *Tape Price, now an average, includes varnishing*

FLUORESCENT LONGEVITY

THE long life of modern fluorescent lamps was stressed by Dr F. A. Benson, vice-president of the Illuminating Engineering Society, at the annual luncheon of the Liverpool Centre last week. The life of hot cathode fluorescent lamps was now well in excess of the minimum rated life of 5,000 hours, while cold cathode lamps lasted for 20,000 burning hours, and the limit had not been reached, he stated.

"Even if lamps are burned for the whole of the 2,500 hours which constitute the normal annual working hours in an office, the installation life of a hot cathode lamp now approaches four years and that of a cold cathode lamp eight to ten years.

"Since there have been very few failures, the day may not be far off when we shall be able to box up lamps in rather inaccessible places, confident that they may be forgotten until the scaffolding goes up again for repainting."

Export Licensing Changes

CHANGES in export licensing for certain commodities came into effect last Monday. Control is removed or imposed for a number of engineering products. Liability to export licensing is redefined in the case of telemetering and telecontrol apparatus, amplifiers, c.r. oscilloscopes, electronic c.r. tubes and vacuum tubes, electromagnetic wave-absorbing materials, metal rolling mills and certain metal working machines.

Full details are given in the Export of Goods (Control) (Amendment No. 3) Order, 1960 (S.I. 1960, No. 335) obtainable from HMSO, price 4d.

£1,000 Safety Contest

MORE than £1,000 is being offered by the National Safety Contest for safety ideas to cut down accidents in industry, on the roads and at home. The contest, which is sponsored by 35 major manufacturing companies, will run from April 25 to May 23, and during this period nearly 100,000 posters will be displayed throughout the country. The finals, to be held in London, may be televised.

Posters and entry forms for display and distribution in factories and offices are available from the National Safety Contest, 36-38 Whitefriars St, E.C.4.

Appliances at Cologne

TEN British firms showed a wide range of domestic appliances at the Cologne Fair last week in a special exhibit arranged jointly by BEAMA and the BoT. Consideration is being given to organising a bigger and more spectacular exhibit next year to promote exports of British appliances to Europe.

"Seven" to Cut Tariffs

A 20% cut in tariffs, to come into force on 1 July next, has been agreed by members of the EFTA "Outer Seven." Discussions are now expected to take place to consider the possibility of extending the tariff cut to the Common Market "Six" on a reciprocal basis.

News in Brief

The English Electric Valve Co. Ltd., and Eitel McCullough Inc., USA, have concluded an agreement for the exchange of technical information and manufacturing know-how over a large range of klystrons, travelling wave tubes and power tubes.

VHF radio communications equipment worth $5 million is to be supplied by Plessey to the Canadian Government for use by the Canadian army.

Value of the Holidays with Pay stamps for the Electrical Contracting Industry being increased by 3d to 8s 9d for journeymen, and 7s 3d for mates, as from 6 June.

Chloride Batteries Ltd. have been awarded the contract for the battery for HMS *Dreadnought*, the navy's first nuclear-powered submarine. The containers and covers will be of resin-impregnated glass-fibre.

Company Activities

GLOOM amid Boom. A fair enough description of stock markets just now both in the United States and in the UK. On Wall St and in Throgmorton St share prices continue to slide against a background of excellent company news so that the Dow Jones industrial index has now dropped 12% from its 1960 peak while the *Financial Times* industrial ordinary index has fallen around 10%. But the Americans will now have to take care that they don't *talk* themselves into recession while here at home pessimism can also be overdone. Market belief grows that the several anti-inflationary warnings which have been trumpeted from high places may be translated into more definite action via next month's Budget Box. It is quite certain, however, that the Chancellor would not want to shut down the consumer boom he went to such great pains to encourage now that the "work-through" to heavier industry is only just really beginning to be felt.

Associated Electrical Industries' trading results announced last week demonstrated the difficulties the heavy electrical companies encountered in "booming" 1959. Group profits after depreciation but including profits on the sale of investments, etc., amounted to £11·097 m —a rise of only £28,000 for the year ended 31 Dec., 1959. Thanks only to a substantial drop in the year's tax charge the net profit comes out at £6,489,807 against £5,100,815 previously, a rise of some 27%. Last year's cable "war" and the reduction in G.P.O. telecommunications orders were, of course, depressive factors operating against the more buoyant sections of the business engaged in electrical appliances, TV tubes, radio valves and lighting manufacture. Further, £750,000 is to be set aside against the losses on the Berkeley nuclear power station. It is not clear whether this, added to the amount already written off into previous year, represents the total amount the company will have to find for its hazardous venture in this new field of energy supply or whether there will be more to pay next year.

The upshot of balance sheet juggling is that cover for the ordinary dividend —maintained at 15%—has been reduced from 1·5 times to 1·2. But the market clearly thought it could all have been a lot worse and expressed itself by marking up the £1 ordinary shares by 3s 6d to 58s 6d although profit taking later trimmed them back to 56s. At this level the shares are now yielding 5·3%. Just as the Chancellor cannot ignore the effects of financial and fiscal spanners thrown into the works of the country's continuing and healthy consumer boom which provides the carrot for heavy industry so investors cannot ignore buying opportunities which AEI's shares now offer, 10s below their 1960 "high."

Elsewhere in last week's electrical share dealings which had about them a certain switch-back quality, we saw J. and F. Stone at one time up to 38s 6d —a rise of 6s on the week—on take-over talk but the price was later trimmed back on profit taking to 33s 3d. Morphy-Richards on the half-yearly statement which told of profits before tax 39% higher touched a new "high" of 41s 10½d before easing back to 40s 9d. Over the week, Hoover's 5s "A" ordinary shares spun back from 104s to 93s 9d, a clear invitation for new buyers to step in while my old favourite Philip Lamps notched up a 2s 3d gain at 146/6 after 149s.

Gloom there was aplenty last week but it was left once again to the electrical market to provide the few bright sparks.—*From our City Correspondent.*

Advance Components

Profits for the year ended 2 Jan. last reached £50,543 (*£29,988*), and the dividend is 15%—2½% more than foreshadowed when the company was made public last November.

Allied Insulators Ltd.

Formed as the result of the merger of Taylor Tunnicliff and Bullers last year, this concern's profits are within 1% of that forecast at the merger (£500,000). Mr P. Cooper, the chairman, reports that there was a reduced demand for a certain class of porcelain during the latter half of the year, resulting in a reduced order book, and although this was offset to some extent by increases in other sections, total outstanding orders were much lower. The past few months has seen a recovery and orders now on hand are satisfactory.

Associated Electrical Industries

For 1959 the group profit is £11,097,880, compared with £11,069,056 for the previous year. That figure is struck after charging depreciation at £6,016,621 (*£4,791,392*) and including a profit on the sale of investments and miscellaneous assets of £1,742,820 (*£350,951*). Taxation charge is £4,608,073 (*£5,968,241*) leaving a net profit of £6,489,807 (*£5,100,815*). Total distribution is again 15%, with a final dividend of 7½%, but payable on the capital as increased by acquisitions. The sum of £750,000 is set aside as a special reserve towards the anticipated loss on constructing the Berkeley nuclear station.

Bakelite Ltd.

Group profit for 1959 amounted to £1,542,750, compared with £809,836 for the previous year. Total dividend is raised 2½% to 17½%, with a final of 11½%. Net profit is £613,482 (*£239,330*).

A. F. Bulgin and Co.

In addition to raising the dividend 5% to 55%, a one-for-two scrip issue in "A" Ordinary shares is proposed, net profit for the year ended, 31 January last, after tax, is £111,880 (*£88,115*).

Desoutter Brothers (Holdings)

For 1959 the group increased to £730,380 (*£603,266*) and, after taxation, etc., the net profit is £375,030 (*£294,807*). A final of 23½% raises the total to 30%.

Ericsson Telephones

Group profit for 1959 dropped to £653,160 (*£1,002,396*). After a smaller taxation charge, the net profit is £483,689 (*£466,020*). A final dividend of 9% tax free again makes the total 13%.

Midland Electric Manufacturing Co.

A recession in industry in the first half of 1959 affected business, but the latter months saw a distinct improvement, and the volume of incoming orders has been running at a considerably higher level than during the corresponding months of the previous year, Mr W. J. Barber, the chairman, reports. In the current year, the present increased activity gives cause for optimism, but he warns that it is intended to reduce prices on certain lines, which would result in lower profits on the present turnover. It is hoped, however, that with a continuation of the present buoyant conditions, there will be an increasing larger share of the market to maintain and possibly increase trading profits.

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1955	532,192	231,465	44	12½	54/5	43/-
1956	555,731	244,001	46	12½	48/9	43/6
1957	587,208	241,843	46	15	54/-	45/-
1958	579,374	241,342	28	10*	44/-	26/5
1959	592,410	260,064	28	12	51/4	41/6

*Plus 66⅔ capital bonus.

Morphy-Richards Ltd.

Group turnover increased about 25% in the six months ended 31 Dec. last, compared with the corresponding period of 1958. Net profit, before tax, exceeded £650,000—an increase of 39%. Improvement in the profit rate, compared with last year, is due mainly to the expansion and diversification of the group's production, Mr F. P. Bishop, the chairman, reports. Although he hesitates to forecast the final results of the current financial year, Mr Bishop adds that sales continue to go well for the time of the year and increasing benefit is expected in the coming months from the new appliances.

Telegraph Condenser Co.

With an increase in the group trading profit from £528,784 to £769,725 for the year to 31 Dec. last, total dividend is raised 10% to 35% with a final of 20% and a 10% cash bonus. In addition a one-for-two scrip issue is proposed. Net profit after taxation is £319,353 (*£187,486*).

Intended Dividend

Antiference. Interim 12½% (*same*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

17 March—Baildon U.D.C. Electrical installation, alterations and renewals in 26 houses on Towngate housing estate—See 3 March issue.

17 March—Magherafelt R.D.C. (b) Provision of electrical services including telephone installation in new district offices.—See 3 March issue.

18 March—Leeds. Electrical installation, on fixed-price basis, in alterations to Pavilion 12 at Seatton Banks Hospital, Knaresborough, for Regional Hospital Board. Details from Architect, L.R.H.B., Park Parade, Harrogate. Deposit £2 2s payable to the Board.

18 March—Ugborough P.C. Installation of 12 140 W sodium lamps on 25 ft concrete columns on A38 at Bittaford.—See 3 March issue.

19 March—Chester-le-Street U.D.C. Supply of lamps for year.—See 10 March issue.

19 March—Chippenham B.C. Supply and/or erection of 103 250 W MBF/U lighting units on concrete columns and 74 80 W pole top lanterns on concrete columns. Borough Surveyor, Municipal Offices, 10 Market Pl, Chippenham. Deposit £2 2s.

19 March—Peterborough T.C. Lighting and power installations in 92 dwellings on Gunthorpe estate and two dwellings on Walton estate. City Engineer, Town Hall, Peterborough. Deposit £2.

19 March—Stroud U.D.C. Supply of (c) electrical accessories for council house improvement scheme. Clerk of the Council, H. S. Gibbons, Council Chmbrs, High St, Stroud, Glos.

21 March—Belfast T.C. (a) Electrical installation in gymnasium in the former Victoria Barracks property. City Architect's Office (Room 53), City Hall, Belfast 1.

21 March—Brentford and Chiswick B.C. Supply and erection of 550 60 W sodium lighting units.—See 10 March issue.

21 March—Ealing B.C. (1) Supply of 56 200 W sodium lanterns and 44 Aero screened pattern, complete with gear and lamps; (2) supply and erection of 100 30 ft steel columns.—Advertised 25 Feb. issue.

21 March—Magherafelt. Electrical installation in new office building in King St for Ministry of Finance.—See 10 March issue.

21 March—Manchester T.C. Electrical installation in Newall View aged persons' home, Wythenshawe. City Architect, P.O. Box 488, Town Hall, Manchester.

21 March—Sunderland T.C. Electrical installations in (a) 253 dwellings and (b) 336 dwellings on Town End Farm estate.—Advertised 25 Feb. issue.

21 March—Tyne Improvement Commission. Supply of (item 13) cable and lamps.—See 10 March issue.

21 March—West Riding C.C. Rewiring of Shipley St. Walburges R.C. School. Applications to County Architect, Bishopgarth, Westfield Rd, Wakefield, by above date. Supply and erection complete of 22 140 W sodium vapour units on 17 concrete columns.—Advertised 10 March issue.

21 March—Wigan T.C. Supply of lamps, cable, Class "A" and "B" concrete columns, m.v. lanterns, control gear for year from 1 April, 1960.—Advertised 10 March issue.

22 March—Coleraine. Electrical installation in new rectory, St. Patrick's Church.—See 10 March issue.

23 March—St. Albans T.C. (1) Provide and erect 54 Group "A" steel columns with lanterns and gear; (2) erection only 75 c.i. columns with brackets and lanterns.—See 10 March issue.

24 March—N. Ireland Hospitals Authority. Supply of (item 4) electrical appliances, equipment for S. Western Special Care M.C.—See 3 March issue.

25 March—Letchworth U.D.C. Erection of 51 Class "B" lamps on Grange estate.—See 10 March issue.

26 March—Selkirk C.C. Electrical work in reconstruction of Knowepark School, Selkirk.—See 10 March issue.

28 March—Armagh C.C. (b) Electrical, heating and plumbing installations in new three-classroom primary school at Lisdrumchor, Glenanne.—See 10 March issue.

28 March—Blackpool T.C. Supply of street lighting equipment.—Advertised 10 March issue.

28 March—Manchester T.C. Supply and installation of passenger lift at Templemead Aged Persons' Home, Wythenshawe. City Architect, P.O. Box 488, Town Hall, Manchester.

28 March—St. Helens T.C. Supply of: (1) 51 Group "A" spun concrete columns and brackets; (2) 140 W sodium lanterns; (3) lamps and auxiliary gear; (4) 4,150 yd p.v.c. insulated s.w.a. cable; (5) 1,000 yd t.r.s. cable.—Advertised 10 March issue.

30 March—Manchester T.C. Electrical installations in: (contract 293) 91 dwellings, Handforth; and (contract 303) four dwellings, Anson estate.—Advertised 10 March issue.

30 March—Manchester T.C. Contract 324 installations of communal television distribution installation plus internal telephone and electric lock installation. Director of Housing, Town, Manchester 2.—Advertised in this issue.

30 March—Willesden B.C. Supply of (1) cable, (2) conduit and (3) switchgear for year.—See 10 March issue.

31 March—Down C.C. Electrical installation in new technical intermediate school at Banbridge for E.C. Details from consulting engineers, M'Candless and Barton, 6 Murray St, Belfast 1. Deposit £3 3s.

31 March—Liskeard B.C. Wiring and installation of power points in three houses at Park View.—See 10 March issue.

31 March—Southport T.C. (1) Electrical and (2) lift installations in new home for the aged at Ainsdale. Borough Architect and Town Planning Officer, 99/105 Lord St, Southport. Deposit £1 1s each item.

31 March—Staffordshire C.C. Provision of 25 units of sodium discharge lighting on steel columns at Friary Roundabout, Lichfield. Details from County Surveyor, County Bldgs, Stafford.

1 April—Manchester T.C. Electrical installation in combined clinic at (a) Charlestown Rd and (b) Plant Hill Rd, Blackley. City Architect, P.O. Box 488, Town Hall, Manchester.

2 April—Oxford T.C. Supply of, item 6, electrical goods for Old People's Home, Harberton Mead. Chief Welfare Officer, Greyfriars, Paradise St, Oxford.

4 April—Chislehurst and Sidcup U.D.C. Applications invited for inclusion in approved list of electrical contractors to Engineer and Surveyor, Manor Hse, Sidcup, by above date.

5 April—Heston and Isleworth B.C. Supply and erection of 31 Group "A" steel columns with 3 x 80 W fluorescent lamps, lanterns and control gear plus removal of 29 existing columns along Whitton Rd, B361.—Advertised 3 March issue.

5 April—Salford T.C. Supply of (1) lamps and (2) cables for year to 30 June, 1961. Details from Street Lighting Superintendent, 9 Frederick Rd, Pendleton, Salford 6.

6 April—E. Suffolk. Supply and erection on River Waveney at Bungay of one electrically operated mild steel sector type sluice gate, 20 ft wide by 7 ft high.—See 25 Feb. issue.

6 April—Yorkshire E.B. Supply of house wiring and mains auxiliary cables.—Advertised 3 March issue.

7 April—Beddington and Wallington B.C. Supply and erection of 54 Group A and 70 Group B concrete columns and totally enclosed lanterns for 140 and 60 W sodium vapour lamps. Borough Engineer, Town Hall, Wallington.

7 April—Belfast T.C. (f)(i) Provision of lighting at approach road, car park and notice board at Annadale Grammar School; (ii) fire alarm and additions to electrical installations at Ballygomartin Boys' Secondary School. (a) Electrical and (c) passenger lift installations at Bookstack Annexe, Central Public Library, Royal Ave. Details from: [contracts (f)(i) and (ii)] Education Architect's Dept., 40 Academy St, Belfast 1; and for contracts (a) and (c) from consulting engineers, M'Candless and Barton, 6 Murray St, Belfast 1. Deposit £3 3s each for (a) and (c), documents on production of receipt from T.C. Chief Cashier.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 112 queries answered this week

"Maybow" oil filled radiators—makers of? S.E.E.B.—Mackey Bowley (Steelworkers) Ltd., 106 Snowfields, S.E.1.

"Startomatic" generator sets—makers of? T.B.—R. A. Lister and Co. Ltd., Dursley, Glos.

Chase Electric Co. Ltd.—address for? S.E.B.—"Lynmede," Roffey, Horsham, Sussex.

"B.N.E." cookers—suppliers of? S.E.B.—British National Electrics Ltd., Victoria Wks, Victoria Way, S.E.7.

"Instanta" relays—makers of? L.E.B.—Magnetic Controls Ltd., Instanta Wks, Upper Stone St, Maidstone, Kent.

"Darling" domestic appliances—agents for? E.B.—Turissa (Great Britain) Ltd., 101-109 Ladbroke Grove, London W.11.

"Kiddie-Chef" battery-operated food mixer—makers of? W.E.—Kenwood Electrics Ltd., Hipley St. Old Woking, Surrey.

"Alundum" refractory cements—agents for? T.E.—Townson and Mercer Ltd., 101 Beddington La, Croydon, Surrey.

Thermostatically controlled soldering irons—makers of? W.K.—Cardross Engineering Co. Ltd., Woodyard Rd, Dumbarton, Scotland.

11 April—Co. Londonderry. Electrical installation in new voluntary primary school at Draperstown. Details from architect and surveyor, M. A. Fitzpatrick, Strand Chmbrs, 16/18 Strand Rd, Londonderry. Deposit £3 3s.

11 April—Gateshead. (2) Electrical installation in new Divisional Fire Station to be erected in Dryden Rd for Newcastle and Gateshead Joint Fire Committee.—See 25 Feb. issue.

12 April—Cannock U.D.C. Supply and installation of two horizontal centrifugal pumping sets with total capacity of 1,500 g.p.m. of crude sewage at a 45 ft head for Bridgtown Pumping Station. Details from Engineer and Surveyor, Council Hse, The Green, Cannock, Staffs.

22 April—Galway C.C. Supply and installation of duplicate 3-ph. motors, horizontal centrifugal pumps and chlorination unit for Ballymoe Water Supply Scheme.—See 3 March issue.

22 June—Loch Striven. Complete electrical installation for P.O.L. storage depot to be constructed at Loch Striven. The work value, £55,000, includes switchgear and control equipment, cables, street and area lighting, building installations, earthing and bonding. —Advertised 10 March issue.

No date stated—Berkshire C.C. Supply and erection of 11 35 ft steel columns, lanterns and other works for Maidenhead By-Pass/A4 roundabout at Maidenhead Thicket. Details from County Surveyor, Shire Hall, Reading. Deposit £2.—Advertised in this issue.

No date stated—Glamorgan. Applications invited for inclusion in prescribed lists for electrical engineering future contracts for Miners' Rehabilitation Centre.—See 10 March issue.

No date stated—Hortham-Brentry Hospital M.C. Supply of engineering, electrical and building materials for year to 31 March, 1961.—See 10 March issue.

No date stated—Jarrow B.C. Applications invited for inclusion in selected list for (g) supply of electrical materials for year to 31 March, 1961.—See 10 March issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

25 March—Denmark. Two 30 kVA diesel generators and converters. Applications concerning N.A.T.O. Infrastructure contract ICB No. 5 to Flyvem-Aterieltjenesten, Flyvestation Vaerloese, Denmark, by above date. B.o.T. [GD/5671/58(5)].*

31 March—France. Electrical and mechanical installations in construction of underground liquid fuel storage depot. Applications concerning N.A.T.O. Infrastructure contract A.E.F. 109, value £435,000 to Directeur des Travaux, Maritimes de la 2 eme Region, Prefecture Maritime, Le Chateau, Brest (Finistere), by above date. B.o.T. [GD/6721/59(5)]*.

3 April—Iraq. 11 kV ring main switchgear units and accessories. Inspectorate-General of Ports and Navigation in Ministry of Communications, Baghdad. B.o.T. (ESB/6864/60).*

5 April—India. Specification C.E.B.T.3/60 distribution transformers. Specification from Superintending Engineer, Technical (Electrical), 10-2-3 A.C. Guards, Hyderabad, Dn 4 on production of challan for Rs 20·40 nP via Reserve Bank of India under Head XLVI Miscellaneous—Sales of Specification—Andhra Pradesh State Electricity Board.

5 April—Pakistan. 11 kV 3-ph. 200 A switchboard, meters, cable end boxes and 11 kV/230 V 60 kVA transformer. Director-General, Dept. of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/6477/60).*

8 April—S. Africa. Four items including rubber and polychloroprene cable. Secretary, Union Tender Board, 291 Bosman St, P.O. Box 371, Pretoria. B.o.T. (ESB/6497/60).*

11 April—Australia. 10 3-ph. 12·1 MVAr at 36·3 kV shunt capacitor banks and 26 33 kV, 1,000 MVA, 3-ph. c.b's; three c.b's for capacitor switching; 87 33 kV s.-ph. current transformers. Commercial Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (ESB/5911 and 2/60).*

21 April—New Zealand. 200 dry air-depolarised cells and 250 1·5 V inert cells. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/6857/60).*

27 April—New Zealand. Two- to eight-way terminal blocks. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/6856/60).*

5 May—India. 660 V and 3·3 kV armoured flexible cables for Neyveli Lignite Corpn. India Store Dept., Government Bldg, Bromyard Ave, W.3. Fee $2. B.o.T. (ESB/7241/60/I.C.A.).*

23 May—Australia. Coal handling plant for Vales Point Power Station. Commercial Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (ESB/6368/60).*

CONTRACTS PLACED

Belfast T.C. Modifications to bell system in Dunlambert Secondary School, Fortwilliam Pk, and electrical installation in residential unit at Fleming Fulton School, Upper Malone Rd, A. N. Trimble and Co. Ltd.; modifications to electrical installation in Model Secondary School for Boys, Ballysellan Rd, Millar and Matchett.

British Railways. Public address systems for Harlow and Stratford-on-Avon stations, Easco Electrical (H) Ltd.

Dewsbury T.C. Electrical installations in houses: Spen Valley Rd housing site, Bickers Ltd., £1677; Eastborough Redevelopment scheme (1), Hammerton and Waring Ltd., £955; Eastborough scheme (2), Bickers Ltd., £702. Recommended.

London C.C. Supply and installation of water heaters in 457 dwellings on Watling estate (Group 4A), F. J. Baynes and Co. Ltd., £25,232 8s.

Swindon B.C. Rewiring and improvements at Ferndale Secondary School, Warnes (Swindon) Ltd., £2,594.

Gazette Announcements

COMPANIES ACTS

Engineering and Scientific Research Ltd. Mr T. S. Stallabrass, 12 Rochester Row, S.W.1, appointed liquidator at extraordinary general meeting on 22 Feb. for the purpose of voluntarily winding-up.

Richard (Swiss Shaver) Ltd. General meeting of members to be held at Devonshire St, Ardwick, Manchester 12, on 8 April, at 11 a.m.

Grunther Instruments Ltd. First meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 18 March, at 11.30 a.m. and 12 noon.

W. E. Knorr and Co. Ltd. Creditors to send details to liquidator: C. F. Smith, 79 Denmark Hill, S.E.15, by 31 March.

BANKRUPTCY ACTS

Intended Dividends

Ashton-under-Lyne. F. Hulme, electronics engineer, of 20 Daisy Hill Rd, Micklehurst, Mossley. Last day for receiving proofs for intended dividend: 18 March, to trustee: J. Tye, 20 Byrom St, Manchester 3.

Norwich. G. R. Overton, radio and electronics engineer, carrying on business at Rockland All Saints, Attleborough. Last day for receiving proofs: 21 March, to trustee: C. A. Taylor, Norfolk Hse, Exchange St, Norwich.

Brentford. F. W. Perry, electrical contractor, formerly carrying on business at 18 Royal Gdns, Boston Rd, Hanwell. Last day for receiving proofs: 22 March, to trustee: W. Whitehead, 58/61 York Terr, Regent's Park, N.W.1.

First Meetings and Public Examinations

Bournemouth. W. E. Beards, radio and electrical engineer, lately carrying on business as B. and S. (Boscombe), at 34 Ashley Rd. First meeting: 12 noon, 17 March, at Official Receiver's Office, 16 Westwood Rd, Southampton; and public examination: 10.30 a.m., 11 May, at Law Courts, Stafford Rd, Bournemouth.

Merthyr Tydfil. T. R. Thomas and E. Jones, electrical and radio engineers, carrying on business as T. R. Thomas and Co., at "Golden Key," Union St, Dowlais. First meeting: 11.30 a.m., 18 March, at Official Receiver's Office, Government Bldgs, 10 St. Mary's Sq, Swansea; and public examination: 11 a.m., 20 May, at Town Hall, Merthyr Tydfil.

Salford. I. Fineberg and C. Wilson, retailers of electrical appliances, formerly carrying on business as "Modern Maid," at 28 Blackfriars St, Manchester 3, and 64 Fountain St, Manchester 2. First meeting: 11 a.m., 23 March, at Official Receiver's Office, 20 Byrom St, Manchester 3; and public examination: 10.30 a.m., 17 June, at Court Hse, Encombe Pl, Salford.

Cardiff. C. G. R. Heider, domestic electrical goods retailer, lately carrying on business as Chancery Electrics at 25 Pearl St, Roath, Cardiff. Public examination: 10.30 a.m. 8 April at County Court, County Court Bldgs, Westgate St, Cardiff.

Leeds. A. H. Freeman, electrical contractor, of 40 Wellhouse Drive, Roundhay Rd, Leeds 7. Public examination: 10.30 a.m. 14 June at County Court Hse, Albion Pl, Leeds 1.

Application for Discharge

High Court of Justice. M. Neidle, electrical contractor, lately trading at 26 Elmer Gdns, Edgware. Application for discharge to be heard at 11 a.m., 1 April, at Bankruptcy Bldgs, Carey St, W.C.2.

Dividends

Salford. W. Price, electrical mainterance fitter, of 41 Cook St, Pendleton. Dividend per £: 1s 4d, payable at Official Receiver's Office, 20 Byrom St, Manchester 3, on 17 March.

Wolverhampton. H. F. Griffiths, electrical engineer, formerly carrying on business at Central Chmbrs, Walsall St, Bilston. Dividend per £: 4s 0½d, payable at Official Receiver's Office, Somerset Hse, 37 Temple St, Birmingham 2, on 25 March.

TRADE NOTES

Change of Address. The address of Lloyd Instruments Ltd. is now 28 Oak Hill Gdns, Woodford Green, Essex. Telephone Buckhurst 2745.

Change of Name. The name of Pelapone Engines Ltd. has been changed to Pelapone Ltd.

New Branch. Crompton Parkinson Ltd. have opened a new branch at Crompton House, Longley La, Wythenshawe, Manchester 22. (Telephone Gatley 8441).

Fire. The recent fire at the Oldham premises of Euk Catering Machinery Ltd., although doing considerable damage, is not expected to affect the production of their kitchen and canteen equipment, we understand.

Ceylon Imports. Restrictions on the import of electric light bulbs in Ceylon have been slightly eased. It is proposed to grant allocations of Rs. 2,500 each to newcomers who are registered as Ceylonese traders, and are allowed to import electrical goods on their general import licences.

S.A. Imports. South African Board of Trade and Industries has been asked by Contactor (Pty.) Ltd. to raise the duty on domestic cooker heating elements from 15% and 20% ad valorem to 25% and 30% respectively.

BUSINESS PROSPECTS

Home

Aberdeen. J. A. O. Allan Ross and Allan are architects for £130,000 extensions proposed by Aberdeen University Press at 6 Upperkirkgate. T.C. recommended to approve £35,000 club premises at Northfield Community Centre.

Armagh. Electrical heating installations for three-classroom primary school at Glenanne. Architects, Hobart and Heron, Scottish Provident Bldgs, Belfast.

Ballyclare. 61 dwellings and garages for N. Ireland Housing Trust, 12 Hope St, Belfast. N.I. Ministry of Commerce propose factory for J. Ambler (Ulster) Ltd., Carrickfergus.

Batley B.C. Plans for erection of factory for Birstall Carpet Co., Birstall.

Belfast. Gordon McKnight, 35 May St, is architect for new £30,000 church hall at Park Rd.—Richardson's Chemical Manure Co. Ltd. and Ulster Manure Co. Ltd., 19 Short Strand, Belfast, propose to erect £2,000,000 factory at Herdman Channel. **T.C.** Erection of two 13-storey blocks of flats at North Queen St. Town Clerk.

Billericay. N.E. Metropolitan Regional Hospital Board approved provision of £66,445 laboratory at St. Andrews Hospital.

Billington R.D.C. £200,000 school to be built on 18 acre site.

Bingham R.D.C. Recommended to approve erection of 110 dwellings this year.

Bolton. Walmsley (Bury) Group Ltd. negotiating purchase of land for £1 million factory.

Bootle B.C. Alterations and additions to girls' grammar school, Breeze Hill. Borough Surveyor.

Bradford. Proposed £134,000 engineering research block. Hepworth and Grandage Ltd., St. John's Works.

Brighton. S.E. Metropolitan Regional Hospital Board recommended to appoint Gotch and Partners, 8 City Rd, E.C.1, architects for new X-ray department and lift at Royal Sussex Hospital.

Cambuslang. Hoover (Electric Motors) Ltd. propose £400,000 extension at Somervell St.

Cardiff T.C. Construction of four classrooms at primary school, Ely. City Architect.

Cardiganshire C.C. Erection of primary school at Comminschoch, Aberystwyth. Architect, County Hall, Aberavon.

Carlisle. Erection of large main block of West Cumberland Hospital. Clerk to the Special Area Committee, 72 Warwick Rd, Carlisle.

Carmarthen. Plans for £1¼ million Glangwill hospital approved by Welsh Regional Hospital Board.

Chester T.C. Erection of 110 houses and flats at Plas Newton estate. City Engineer and Surveyor.

Clydebank T.C. Electrical work on 216 houses in Central Redevelopment Area. Burgh Surveyor.

Coleraine. Construction of fire station at Lodge Rd. N. Ireland Fire Authority, Secretary, H. B. Reid, 43 Castle St, Lisburn.

Cornwall. Construction of out-patients' dept. at Stratton Hospital. Supt. Engineer, P. Ruberry, Works Dept., 7 Nelson Gdns, Stoke, Plymouth.

Cranbrook R.D.C. Erection of Council Offices and Chamber. Clerk of the Council.

Durham C.C. To build 14 police houses at Swalwell. County Architect. Twenty houses at Belmont. Erection of dental clinic at Spennymoor. County Architect. T.C. Erection of 10 bungalows at Benthouse La. City Engineer.

Easington R.D.C. To erect 175 houses during current year. Surveyor, R. R. Lumsden.

East Grinstead. G. M. Crockett, of Howard, Leicester and Crockett, Shoreham, is architect for Glen Vue development plan. All blocks to have electric under-floor heating and electric incinerators. First stage, five- seven- and four-storey blocks commenced at contract price of £150,578.

Edinburgh T.C. Alterations to education offices, St. Giles St. City Architect.

Ennerdale. Housing Committee approved layout for stage one of housing site at Egremont. 134 three-bedroom and 60 four-bedroom houses and garages, plus 99 houses for slum clearance. R.D.C. Ministry approved erection of 50 houses and 27 bungalows at two sites.

Essex C.C. Erection of assembly hall and kitchen at primary school. Architect, H. Connolly, County Hall, Chelmsford. **C.C.** Erection of four-, three- and one-storey accommodation blocks for St. Osyth's Training College, Clacton. Cost: £230,000. County Architect.

Falkirk. Extensions to £75,000 Woolworth's store at High St approved by Dean of Guild Court.

Glasgow T.C. Tenders to be invited for extensions to school at Charlotte St. City Architect. Finishing contracts for four 17-storey blocks of flats under construction at Hutchesontown/Gorbals Building Area "B." Town Clerk.—Gorbals scheme for 400 houses in 20-storey blocks, all with electric underfloor heating.

Gloucestershire C.C. Extensions to Stroud and District Technical College. Architect, Shire Hall, Gloucester.

Grantham. Plans approved for new malting in Commercial Rd and Rycroft St for Lee and Grinling Ltd., Commercial Rd, Grantham, Lincs.

Ilford B.C. Recommended to prepare drawings for £150,000 stage one development of The Glade. Six blocks of flats and garages.

Isle of Ely C.C. £85,000 extensions to High school during 1961/62. County Architect.

Kingston upon Thames B.C. Erection of C.D. rescue training set. Borough Surveyor.

Kirkcaldy B.C. Approved erection of seven five-storey blocks and a two-storey block of houses.

Larkhall. £500,000 factory extension for S. Simpson Ltd. approved by Board of Trade.

Letchworth U.D.C. Tenders to be invited for proposed extensions to library and museum at Broadway. Clerk of the Council.

Lincolnshire C.C. Erection of schools at Billingborough, Billinghay and Corby Glen. Architect, County Offices, Sleaford.

Liverpool T.C. Proposed erection of 22-storey block of flats at Harding St.

Luton B.C. Development permission granted for 84 dwellings and garages east of Westmorland Rd.

Maidstone B.C. Ministry approved programme for 200 dwellings at three sites.

Margate. S.E. Met. Regional Hospital Board propose £75,000 improvements to General Hospital.

Middlesex C.C. Recommended to approve erection of the following: £222,296 hotel and catering department at Ealing Technical College. £252,840 school at Enfield and new buildings for Chase Girls' School costing £201,260. £165,175 extensions to Headstone Secondary School. £124,303 extensions to Mount Grace Secondary School. Southall County Secondary School, £190,682. Dormers Wells Secondary Boys' and Girls' Schools, £61,795.

Montgomeryshire. Erection of canteen at primary school near Llanbrynair. Director of Education.

Newport. Welsh Regional Hospital Board approved plans for £1,380,000 development of Royal Gwent Hospital.

Nottingham T.C. Construction of kitchen at Trent Bridge School. City Engineer.

Oswaldtwistle U.D.C. Recommended to approve plans for 218 bungalows and 90 houses for M. Edmundson Ltd., Accrington.

Penrith T.C. To erect 109 houses and four shops at Letham. Burgh Surveyor.

Peterborough. Erection of assembly hall, kitchen and accommodation at County Boys' School. Architects, Warwick and Ellis, 43a Priestgate.

Plymouth. Vincent Burr and Ptnrs, 85 Gower St, W.C.1, architects for £800,000 hotel proposed for Plymouth Hoe.

Southend-on-Sea. D. S. Lichtie, 24 Spareleaze Hill, Loughton, Essex, is architect for 15-storey block of flats at Westcliff Parade.

Spennymoor U.D.C. Extensive alterations and additions to Spennymoor Town Hall. Architects, G. H. Gray and Ptnr, Camdan St, North Shields.

Stratford-on-Avon B.C. Improvements and repairs to houses on Clopton estate. Borough Engineer.

Sunderland E.C. Erection of technical college in South Johnson St. The Education Committee received sanction to borrow £250,533 for first phase of the Monkwearmouth Comprehensive School. Borough Architect. **B.C.** Erection of technical college. Architect, Grange Hse, Stockton Rd.

Stockton-on-Tees. Dolphin Development Co., Duncan Hse, Dolphin Sq, London, to erect 172 houses on Fewster's nursery site. John Graham (Quarries) Ltd., Piercebridge, Yorkshire, to establish a ready-mixed concrete plant with ancillary buildings at Haverton Hill Rd. Corporation Libraries Committee is considering a £110,000 scheme for the construction of central library in Hunter La. Borough Architect.

Wallasey B.C. Construction of assembly hall and kitchen at Egerton Grove School. Borough Architect.

Wednesbury. Housing Committee have applied to Ministry for approval of 100 Wimpey non-traditional houses on two sites.

Wellington R.D.C. Approved in principle scheme by Gregory Housing Ltd. for 244 dwellings at Sandown housing site, Ketley.

West Lancashire R.D.C. To approve recommendations for erection of 1,930 street lamps in district at cost of £82,010.

Windsor. Factory Construction Ltd. propose erection of 11 factories at Arthur Rd.

Wokingham. Permission granted for erection of factory at Eastheath for Wokingham Plastics Ltd

Worcester T.C. Erection of 65 dwellings at Moor St Redevelopment Area. Town Clerk.

Workington T.C. Plans by J. Saul, National Provincial Bank Chmbrs, Workington, for erection of two-storey office block in Oxford St for John Twinams Ltd., Allerdale Hse, Brigham, and extensions to National Provincial Bank in Pow St.

Worthing B.C. Recommended to invite tenders for 64 dwellings near Limbrick La.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Aquatron. 792,931. Class 9. Electrostatic precipitators. Sturtevant Eng. Co. Ltd., Southern Hse, Cannon St, E.C.4.

Baldwin-Atlantic. 791,308. Class 11. Refrigerators, etc. H. J. Baldwin and Co. Ltd., 605 Mansfield Rd, Nottingham.

Cedco. 794,297. Class 11. Lighting fittings. Claremont Electrical Distributing Co. Ltd., 71a Cricklewood Broadway, N.W.2.

Hardale. 796,235. Class 9. Radiogramophones, etc. Hardman and Co. Ltd., Hardale Hse, Baillie St, Rochdale.

Norg. B792,550. Class 7. Washing and drying machines, etc. Borg-Warner Corpn., 200 South Michigan Ave, Chicago 4, Cook County, Illinois, U.S.A.

RG in design. 790,766. Class 9. Apparatus, etc. Reliance Gear Co. Ltd., St. Helens Gate, Almondbury, Huddersfield.

MEETINGS TO NOTE

THURSDAY, 17 MARCH

I.E.E. (Scottish Centre). Dinner at George Hotel, Edinburgh. 6.30 p.m.

A.S.E.E. (Oxford Branch). "Earthing and Earth Leakage Protection of Electrical Installations," J. A. Robbins. Reactor School, A.E.R.E., Harwell. 5.45 p.m.

INSTITUTE OF PHYSICS. "The Friction and Deformation of Solids at Very High Speed," Prof F. P. Bowden, 47 Belgrave Sq, S.W.1. 6 p.m.

BRITISH ASSOCIATION OF CORROSION ENGINEERS. "Anti-corrosive Protection of Underground and Underwater Pipelines," G. McHardy. Institute of Welding, 54 Princes Gate, S.W.7. 6.30 p.m.

FRIDAY, 18 MARCH

I.E.E. (London Graduate and Students' Section). Annual joint lecture, Sir George Edwards. Institution of Mechanical Engineers, 1 Birdcage Walk, S.W.1. 6.30 p.m.

A.S.E.E. (Stoke and Crewe Branch). "Modern Trends in Industrial and Commercial Lighting Installations," V. Heydon. Royal Hotel, Crewe. 7.30 p.m.

ROYAL INSTITUTION. "Infra-red Radiation," R. V. Jones, 21 Albemarle St, W.1. 9 p.m.

PLASTICS INSTITUTE (Midlands Section). "Silicones in the Plastics and Rubber Industries," P. A. J. Gate. James Watt Memorial Institute, Gt. Charles St, Birmingham 3. 6.30 p.m.

MONDAY, 21 MARCH

I.E.E. (N.E. Centre). "The Shielding of o/h Lines Against Lightning," J. H. Gridley. Neville Hall, Westgate Rd, Newcastle. 6.15 p.m.

I.E.E. (Sheffield Sub-Centre). "Education for Electrical Engineering with particular reference to the new IEE Regulations," Prof G. W. Carter. Angel Hotel, Brigg. 7 p.m.

I.E.E. (N. Staffs Sub-Centre). Joint meeting with Graduate and Student Section. Technical College, Stafford. 7 p.m.

I.E.E. (Western Supply Group). "Construction Problems," R. Lefeure. S. Wales Institute of Engineers, Park Pl, Cardiff. 6 p.m.

I.E.E. (London Graduate and Student Section). "Developments in Lighting," Dr F. A. Benson. Savoy Pl, W.C.2. 6.30 p.m.

I.E.E. (London Graduate and Student Section). "Inertial Navigation Systems," Wing Cmdr. E. W. Anderson. Assembly Hall, 3 (Tels) Trng Bn, R.E.M.E., Arborfield, Berks. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS (Sheffield Section). "The Engineer's Role in Nuclear Power," Prof J. M. Kay. Royal Victoria Hotel, Sheffield. 7.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS. Discussion, "The Computer in Production." 1 Birdcage Walk, S.W.1. 6 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (Sheffield Graduate Section). "Electronic Control Mechanism," O. S. Puckle. Devonshire Room, Grand Hotel, Sheffield. 6.45 p.m.

INSTITUTE OF PHYSICS (Manchester Branch). Astronomical and Atomic Time," Dr L. Essen. Manchester University. 7 p.m.

I.E.S. (Bath and Bristol Section). "The Integration of Light with Sound," H. Hewitt. Gardiner, Sons and Co. Ltd., Broad Plain, Bristol.

I.E.S. (Leeds Centre). Survey of "Lighting in Corrosive, Flammable and Explosive Situations," J. G. Holmes. British Lighting Council, 24 Aire St, Leeds 1. 6.15 p.m.

IPSWICH AND DISTRICT ELECTRICAL ASSOCIATION. "Light Amusement," V. G. Neal. Electric Hse, Ipswich. 7.15 p.m.

BIRMINGHAM ELECTRIC CLUB. Annual General Meeting. Grand Hotel, Birmingham. 5.30 p.m.

E.A.W. Caroline Haslett Lecture: "Electricity, the Way of Life in Australia," Kay Pennet. Royal Commonwealth Society Hall, Craven St, W.C.2. 6 p.m.

TUESDAY, 22 MARCH

I.E.E. (N.W. Measurement and Control Group). Discussion, "Electrical Railway Signalling and Control." Engineers' Club, Albert Sq, Manchester. 6.15 p.m.

A.S.E.E. (Aldershot Branch). "Electrical Hazards at Home," S. J. Emerson. Prince of Wales Hotel, Woodbridge Rd, Guildford. 7.30 p.m.

A.S.E.E. (E. Kent Branch). "The National Inspection Council and Its Effect on the Electrical Contracting Industry," E. J. Sutton. Clarendon Hotel, Broadstairs. 8 p.m.

JUNIOR INSTITUTION OF ENGINEERS (N.W. Section). "The Engineer's Role in Nuclear Power." Prof J. M. Kay. Engineers' Club, Albert Sq, Manchester. 7 p.m.

INSTITUTE OF PHYSICS (Electronics Group). Group annual general meeting and "Neutron Sources," P. O. Hawkins. 47 Belgrave Sq, S.W.1. 5.30 p.m.

INSTITUTION OF CIVIL ENGINEERS. James Forrest Lecture, "Plastics in Engineering," R. Beeching. Gt. George St, S.W.1. 5.30 p.m.

INSTITUTE OF FUEL (Scottish Section). "Electro Precipitators," J. Martin and J. E. Sayers. Royal College of Science and Technology, Glasgow. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY. Conference, "The Value of Instruments and Automatic Control to the Smaller Firms." Grand Hotel, Bristol.

WEDNESDAY, 23 MARCH

I.E.E. (Electronics and Communications Section). "The Challenge of the Propagation Medium to the Radio Engineer," G. Millington. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (S.W. Scotland Sub-Centre). "The Logmotor—A Cylindrical Brushless Variable Speed Induction Motor," Prof F. C. Williams, E. R. Laithwaite, J. F. Eastham and L. S. Piggott. Institution Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow C.2. 6 p.m.

I.E.E. (Southern Centre). "Electrical Phenomena at Very Low Temperature," Dr R. E. Hayes. Plessey Wks, Romsey, Hants. 6.30 p.m.

INSTITUTE OF FUEL. "A New Process for Briquetting Coal Without a Binder," H. R. Gregory. Institution Civil Engineers, Gt. George St, S.W.1. 5.30 p.m.

ROYAL SOCIETY OF ARTS. "Modern Trends in Industrial Design," Sir Gordon Russell. John Adam St, W.C.2. 2.30 p.m.

INSTITUTE OF WELDING (Medway Section). "Developments in Automatic Welding," A. M. Horsfield. Sun Hotel, Chatham. 7.30 p.m.

THURSDAY, 24 MARCH

A.S.E.E. (Southampton Branch). "Floor Warming and Space Heating," D. W. Ackery. Polygon Hotel, Southampton. 8 p.m.

A.S.E.E. "Meters and Metering." Greyhound Hotel, High St, Croydon. 8 p.m.

INSTITUTE OF FUEL (Midland Section). "Waste Heat Recovery," G. H. Steward. John Thompson Lecture Hall, Etingshall, Wolverhampton. 6.30 p.m.

FRIDAY, 25 MARCH

I.E.E. (N. Midlands Centre). Annual dinner/dance at Refectory, University Hse, Leeds University. 7.30 p.m.

A.S.E.E. (Coventry Branch). "Modern Light Sources," W. A. R. Stoyle. E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy La, Coventry. 7.45 p.m.

A.S.E.E. Annual dinner. Grosvenor Hse, Park La, W.1.

I.E.E. (N.E. Graduate and Student Section). "Reactor Instrumentation," R. G. Gold. Grey Hall, King's College, Newcastle. 6.30 p.m.

MANCHESTER ASSOCIATION OF ENGINEERS. Annual general meeting and "The Design and the the Erection of the Atomium," F. Hebrant. Engineers' Club, Albert Sq, Manchester 2. 6.45 p.m.

NEWPORT AND DISTRICT ELECTRIC CLUB. Dinner/dance at St. Mellons County Club.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Victor Barnes and Co. Ltd., 44 Bedford Row, W.C.1. Manufacturers of and dealers in electrical, fluorescent and tungsten lamps, etc. Nom. cap.: £100. Dirs.: Leonard G. Pizzey and Patrick J. Maginn.

Direct Electrical Supplies (Wholesale) Ltd., 545 Garratt La, Earlsfield, S.W.18. Secretary: Marion S. Obodynski. Nom. cap.: £500. Dirs.: Marian Obodynski and Marion S. Obodynski.

Dynamatic Ltd. Manufacturers of electrical apparatus, etc. Nom. cap.: £100. Dirs.: Fredk. D. Holloway, 68 Sherefoot La, Four Oaks, Sutton Coldfield. Sub.: Kathleen M. Jones.

Electropulse Ltd., 36 Spring Gdns, Manchester 2. Manufacturers of and dealers in electronic instruments, etc. Nom. cap.: £100. Dirs.: Adolf Abel and Walter Abel.

Esbematic Ltd., 120 Bishopsgate, E.C.2. Manufacturers of and dealers in electrical appliances, etc. Nom. cap.: £1,000. Dir.: Istvan S. W. Boros.

Goodway Machinery Co. Ltd., 31 St. Nicholas St, Bristol 1. Electrical and mechanical engineers, etc. Nom. cap.: £500. Dirs.: Alfred G. Gooding and Raymond A. Harding.

E. H. Havill and Co. (Torquay) Ltd., 76 Babbacombe Rd, Torquay, Devon. To carry on the business of electrical equipment specialists, etc. Nom. cap.: £4,000. Dirs.: Edwin H. Havill and Mrs Doris I. Havill.

F. Horn (Household Electrical Equipment) Ltd., 55 Park La, W.1. Nom. cap.: £100. Permanent dirs.: Frits Horn and Herbert Goodier.

Lancashire Dynamo Construction Ltd., 229 High St, Acton W.3. Electrical, mechanical, hydraulic and general engineers, etc. Nom. cap.: £100. Dirs.: Ernest J. Daws.

Marlite Ltd., 47 Oxford St, W.1. Manufacturers of and dealers in electrical discharge tubes, X-ray valves and tubes, etc. Nom. cap.: £100. Dir.: Victor Kano.

Mead (Consultants) Ltd., 162 Uxbridge Rd, W.13. Manufacturers, installers and proprietors of lifts escalators and hoists of all kinds and as advisers to marine, precision, electronic, electrical productions, mechanical and general engineers, etc. Nom. cap.: £100. Dirs.: William H. Mead and Elsie M. Mead.

Metropolitan-Vickers Electrical Co. Ltd. The name and address of one of the directors registered under this company should have read Norman Elce, "Stanhill," Delamer Rd, Bowdon, Ches.

Walter J. Parsons (Electrical Engineeers) Ltd., 127 Morville St, Ladywood, Birmingham 16. Nom. cap.: £500. Permanent dirs.: Walter Parsons and Roger F. Jones.

Perryvale Electrical Appliances Ltd., 68 East Ave, Hayes, Middx. Nom. cap.: £1,000. Dirs.: Derek M. Hurley and Gregory A. Coker.

Polaparents Ltd., 50 Leadenhall St, E.C.3. Importers, exporters, distributors and manufacturers of and dealers in mechanical and electrical apparatus, instruments and equipment, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Subs.: Maurice Bennett and C. J. A. Dixon.

Powis Electrical Co. Ltd., 170 St. John St. E.C.1. Nom. cap.: £5,000. Dirs.: Joseph Levy and Hannah Levy.

Radcliffe (Electrical Newquay) Ltd., Morfa Hall, Cliff Rd, Newquay, Cornwall. Nom. cap.: £10,000. Manufacturers of and dealers in electrical and gas apparatus, catering equipment, etc. Dirs.: Rex Radcliffe and Mrs D. I. E. Radcliffe.

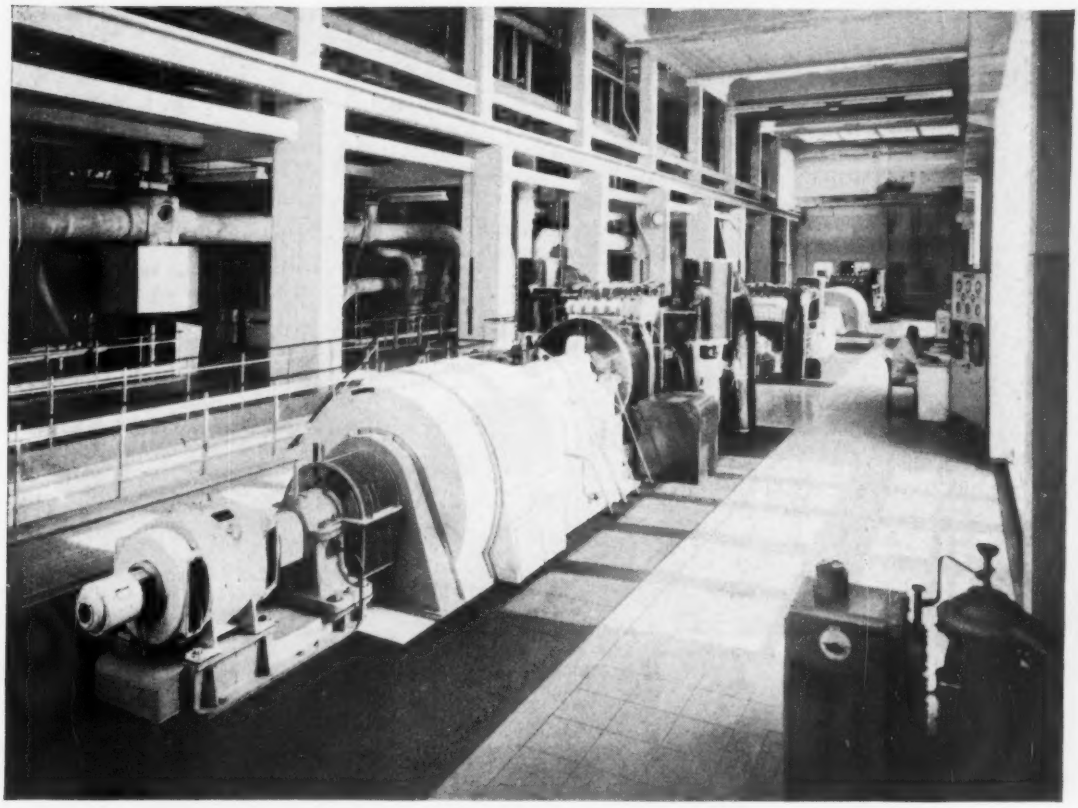
Scott's Electrical Wholesalers Ltd., 91 Poole Rd, Westbourne, Bournemouth. Nom. cap.: £2,000. Permanent dirs.: Cyril F. Scott and Malcolm G. Scott.

Sidden Electric (Manchester) Ltd., 93 Gt. Jackson St, Manchester 15. Nom. cap.: £100. Dirs.: Dennis V. Belcher, Sidney Dean and Victor H. Clow.

Vogue Electrics Ltd., 64 High St, Chislehurst, Kent. Electricians, etc. Nom. cap.: £750. Dirs.: Leslie Clark, Sydney C. Barkway and Dennis P. Albiston.

Wereco Ltd., 49 High St, Houghton Conquest, Bedford. Designers, manufacturers of and dealers in electrical apparatus, etc. Nom. cap.: £100. Permanent dirs.: Michael J. O'Connor, Thomas Rice and Reginald H. Watts.

Power from Process Steam



Two 4520 kW Back-pressure, and two 2500 kW Extraction Back-pressure turbine-generators are installed at the Merseyside Power Station of Lever Brothers, Port Sunlight, Ltd.

They are driven by the steam generated for process work and, operating in parallel with the National Grid, provide the electricity for the factory, helping to minimise overall fuel costs.

Extensive experience in the design and manufacture of extraction and back-pressure turbines enables AEI to advise on applications in your particular industry. For further particulars write to AEI Turbine-Generator Division, Rugby or your local AEI office.

AEI TURBINE-GENERATOR DIVISION

Associated Electrical Industries Limited

WORKS AT MANCHESTER AND RUGBY, ENGLAND · GLASGOW, SCOTLAND · LARNE, NORTHERN IRELAND

Master Control Cubicle

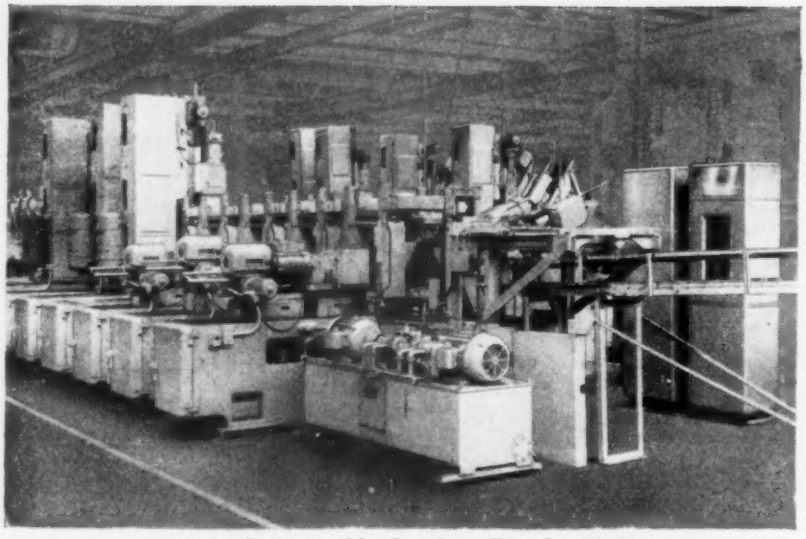
'ACCESS'

(Austin Cold-Cathode Electronic Switching System, made under Licence from the Austin Motor Co. Ltd. and Hivac Ltd.)

A static switching system using Cold-Cathode Tubes, ACCESS possesses the advantage of self indication.

This control system is suitable for many applications including complex machine tool and conveyor installations.

Write for Technical Literature.



Typical Application - Metalworking Transfer Machine

THE DONOVAN ELECTRICAL CO. LTD.

(ELECTRONICS DIVISION)

SAFUSE WORKS · NORTHCOTE ROAD · STECHFORD · BIRMINGHAM 33

Telephone: STECHFORD 2277 (5 lines)

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

CHISLEHURST AND SIDCUP URBAN DISTRICT COUNCIL

Approved List of Electrical Contractors

THE Council are about to draw up a list of approved electrical contractors to tender for the Council's contract work. Firms wishing to be considered for inclusion on this list should forward their names to the Engineer and Surveyor, Manor Hse, Sidcup, Kent, by 4 April, 1960. (P 438)

MANCHESTER CORPORATION

Housing Committee

TENDERS invited (returnable 30 March, 1960) for the following installations at Contract 324, Kingsgate, Wythenshawe.

COMMUNAL TELEVISION DISTRIBUTION INSTALLATION
AND
INTERNAL TELEPHONE AND ELECTRIC LOCK INSTALLATION

Particulars and documents obtainable from the Director of Housing, Town Hall, Manchester 2. (P 415)

COUNTY BOROUGH OF WIGAN

Streets Lighting Department

TENDERS are invited for the supply during the twelve months commencing 1 April, 1960, for the following materials.

Class "A" and "B" Concrete Columns.
Class "A" and "B" Mercury Vapour Lanterns.
Class "A" and "B" Mercury Vapour Control Gear.
Electric Lamps.
Electric Cable.

Forms of Tender are obtainable from the Borough and Water Engineer, Municipal Bldgs, Hewlett St, Wigan.

Tenders, enclosed in plain sealed envelope and endorsed, "Tender for Street Lighting Equipment," must be returned to me not later than 21 March, 1960.

ALLAN ROYLE,
Town Clerk.

Municipal Bldgs,
Wigan. (P 336)

CITY OF BELFAST

TENDERS are invited for:

Coal Supplies (British or Foreign)

viz., the supply and delivery of approximately 530,000 tons of Coal to Belfast Municipal Electric Power Stations during 12 months commencing 1 May, 1960.

Form of tender and conditions, etc., may be obtained at Electricity Department, East Bridge St, Belfast 1.

Each tender, in sealed envelope marked "Tender for Coal—Electricity Committee" and endorsed with the name and address of the tenderer, must reach the undersigned not later than 10 a.m. on Wednesday, 30 March, 1960.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall,
Belfast 1.
P.O. Box 234.
9 March, 1960. (P 416)

ROYAL COUNTY OF BERKSHIRE

Maidenhead By-Pass

TENDERS are invited for the lighting of the roundabout at the junction of Maidenhead By-pass and the Trunk Road (A.4) at Maidenhead Thicket.

The work consists of the supply and erection of 11 35 ft high steel columns and lanterns and other works in accordance with the Contract Documents which may be obtained from the County Surveyor, Shire Hall, Reading, on payment of a deposit of £2, returnable after a bona fide tender has been received.

Tenders to be returned to the Clerk of the Council, Shire Hall, Reading, not later than the date marked on the envelope provided for the return of the Contract Documents.

The Council do not bind themselves to accept the lowest or any tender. (P 428)

APPOINTMENTS VACANT

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS' ENGINEER

REQUIRED at Mold. Salary within range £710/£755 per annum (N.J.B., F/11).

Applicants should have completed a recognised electrical apprenticeship and had engineering training. Duties will include estimating, preparation of specifications and supervision of contracting work, advising consumers on matters relating to electricity supply and the utilisation of electricity.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity Hse, Rhostyllen, nr. Wrexham. Closing date: 29 March, 1960. (P 418)

MID AND SOUTH EAST CHESHIRE WATER BOARD

STATION SUPERINTENDENT

A STATION SUPERINTENDENT is required at the new filtration station of the Mid and South East Cheshire Water Board at Hurleston, nr. Nantwich, Cheshire. He will be responsible for the operation of these works which provide first-class opportunities for learning advanced waterworks practice, employing modern techniques.

Applicants must have served a proper apprenticeship, be active, capable of directing small groups of operatives and to plan maintenance. Preference will be given to applicants having good qualifications in electrical engineering and experience in the maintenance of electrical equipment. Mechanical experience of prime movers will be an advantage. Full training in the specialised techniques will be given.

Salary: £715/£775 p.a., plus fixed overtime of £2 12s 6d per week. New house at low rent of £1 per week in pleasant surroundings near attractive town of Nantwich. Superannuation.

Application form from Delwyn G. Davies, Engineer and Manager, Weaverham Grange, Hartford, Northwich, Cheshire.

Closing date: Monday, 28 March, 1960. (P 312)

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for the following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule D. Salary includes London Allowance.

SENIOR DRAUGHTSMAN (ELECTRICAL)

GENERATION DEPARTMENT
CONSTRUCTION SECTION
GENERATION HOUSE

DIVISIONAL HEADQUARTERS
GREAT PORTLAND ST, W.1

Vacancy No. 60/174.

Qualifications to H.N.C. or equivalent with experience in all types of Electrical Equipment and Control Gear associated with large modern Generating Stations including lighting and heating. An apprenticeship and/or practical knowledge gained with a manufacturing firm would be an advantage. Salary: £980/£1,080 per annum, Grade 4.

Applications, quoting vacancy number, may be made on the standard form obtainable locally and sent to the Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box No. 136, London W.1, by 29 March, 1960. (P 402)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER
(LANARK DISTRICT)

APPLICATIONS are invited for the appointment of Second Assistant District Engineer in Lanark District. Applicants should possess recognised technical qualifications and have had a sound engineering training. They should have had subsequent experience in the maintenance and operation of H.V. and L.V. overhead and underground networks and of H.V. Substations on a large distribution system. They should also be conversant with load-flow diagrams, voltage drop and short circuit calculations and should have had experience on H.V. fault location.

The Salary and Conditions of Service for the Appointment will be in accordance with the National Joint Board Agreement, Schedule A, the present Classification and Grading being E.7. Salary £860/£905. It is a condition of this appointment that the successful candidate shall reside within a reasonable distance of the District Office at Lanark, and take standby duty in accordance with the above Agreement.

Application forms which may be had from the undersigned should be returned to this office within 14 days of the date of this advertisement.

R. J. RENNIE,
Manager.

Montrose Cres,
Hamilton. (P 423)

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

ASSISTANT ENGINEER (EFFICIENCY)
EARLEY GENERATING STATION, READING

APPLICANTS should have had considerable experience in the operation and testing of plant installed in a large modern generating station using pulverised fuel. Preference will be given to those possessing qualifications leading to corporate membership of a recognised professional institution.

Housing accommodation will be available for the successful applicant.

Salary: N.J.B., Grade G.7, £965 x £20—£1,025.

Special application forms obtainable only from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned by 30 March, 1960. Please quote vacancy No. SEC/3.68/T. (P 425)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

SOUTH OF SCOTLAND ELECTRICITY BOARD

Glasgow Area

Vacancy—Reference No. T/60/7

THIRD ASSISTANT ENGINEER
PLANNING AND DEVELOPMENT

APPLICATIONS are invited to fill the above vacancy at Area Headquarters.

Applicants should have a sound engineering training with subsequent experience in the design and layout of large distribution systems at pressures of up to and including 33 kV in a densely loaded industrial and residential area. A knowledge of the application of modern protective equipment and of the calculation of fault levels and preparation of load flow diagrams is desirable.

The possession of the Higher National Certificate or equivalent qualification is desirable.

The conditions of employment will be in accordance with the National Joint Board Agreement for the Electricity Supply Industry.

Salary Scale £1,025/1,085 per annum, Class L, Grade 10. The successful candidate will require to reside within reasonable distance of Area Headquarters.

Applications, quoting the above reference number, should be made on the standard form which may be obtained from the undersigned and should be returned within fourteen days of the appearance of this notice.

A. KELSO,
Manager.

P.O. Box 6,
75 Waterloo St,
Glasgow C.2. (P 382)

BAHRAIN GOVERNMENT

MAINTENANCE ENGINEERS

REQUIRED on contract for one tour of two years in first instance. Salary according to age and experience in scale £1,485 rising to £1,890 a year. Kit and baggage allowance £60. Gratuity at the rate of one month's salary for each year of service. Liberal leave on full salary. Free passages, officer, wife and two children under 18 years. Candidates should be between 28 and 45 years of age and should possess H.N.C. or equivalent qualifications in Electrical Engineering. They should have considerable experience of power station electrical plant including diesel and gas turbine alternators, 11 kV switchgear and all associated auxiliaries. Write to the Crown Agents, 4 Millbank, London S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/50959/EE. (P 399)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Clyde Area

SENIOR ASSISTANT ENGINEER
(COMMERCIAL)

APPLICATIONS are invited for the above position.

Applicants should be Corporate Members of the Institution of Electrical Engineers, the Institution of Mechanical Engineers or the Institution of Heating and Ventilating Engineers and have a sound theoretical knowledge and practical training in the preparation and specification of all types of electrical space heating and ventilation schemes, including hot water central heating using electrode boilers and similar equipment.

The post is on Class K, Grade 5, £1,360/£1,450 per annum of the National Joint Board Agreement and the conditions of employment will be in accordance with that Agreement.

The successful candidate will require to reside within reasonable distance of Area Headquarters.

Applications on the standard form, which may be obtained from the undersigned, should be completed and returned not later than Saturday, 26 March, 1960.

DANIEL ROSS,
Manager.

P.O. Box 15,
206 St. Vincent St,
Glasgow C.2. (P 424)

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

APPLICATIONS are invited for appointment as LECTURER in the Department of Electrical Engineering, with special reference to the transmission and distribution of electric power. Candidates should have a good honours degree in electrical engineering or the equivalent, and ability to participate in research work in this field.

Salary range £900 x £50—£1,350 (bar) x £75—£1,650 per annum with F.S.S.U. benefits and London and Family Allowances. Three copies of application, giving details of qualifications and experience and the names of two referees, should reach Professor A. Tustin, Department of Electrical Engineering, Imperial College of Science and Technology, London S.W.7, by 9 April, 1960. (P 389)

PATENT EXAMINERS AND PATENT OFFICERS

PENSIONABLE posts for men or women for work on the examination of Patent applications. Age at least 21 and under 29 (36 for Examiners), with extension for regular Forces service and Overseas Civil Service. Qualifications: normally first or second class honours degree in physics, chemistry, engineering or mathematics, or equivalent attainment, or professional qualification, eg., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.R.I.C. London salary (men): £655/£1,460; provision for starting pay above minimum. Promotion prospects. Write Civil Service Commission, 17 North Audley St, London W.1, for application form, quoting S/128/60, and stating date of birth. (P 391)

THE NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF ASSISTANT SECRETARY
(ADMINISTRATION)

APPLICATIONS are invited for the above post at the Board's Headquarters, Manchester. Duties will include the control of establishment, education, training, welfare and administration.

The appointment is superannuable and subject to the conditions of the National Joint Managerial and Higher Executive Grades Committee for the Electricity Supply Industry. The salary (Grade 8) £2,560 rising to £2,760.

Applications must be made on forms obtained from the Secretary, The North Western Electricity Board, Cheetwood Rd, Manchester 8, and must be returned not later than 8 April.

PRINCIPAL ASSISTANT
(PRESS AND PUBLICITY)
COMMERCIAL DEPARTMENT
AREA BOARD HEADQUARTERS

Duties will include the preparation of sales leaflets and Press advertising. The successful candidate must be able to prepare original ideas, rough layouts and copy for Agents to develop. Experience in an advertising agency and knowledge of domestic electrical appliances an advantage.

Salary Scale: £1,070 x £30—£1,160 p.a. Grade 7. N.J.C. Conditions.

Applications must be made on forms obtained from the Secretary, The North Western Electricity Board, Cheetwood Rd, Manchester 8, and returned to him by 28 March, 1960.

SENIOR DRAUGHTSMAN
(ARCHITECTURE AND BUILDINGS)
SUB-AREA ENGINEERING DEPARTMENT
OLDHAM

Applicants should have a good general and technical education and be experienced in the preparing of working and detailed drawings for commercial and industrial buildings.

Salary Scale: £790/£890 p.a. Schedule D, Grade 5. N.J.B. Conditions.

Applications must be made on a form to be obtained from the Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, and returned to him so as to be received not later than 28 March, 1960. (P 400)

THE SOUTH WALES ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT ENGINEER

APPLICATIONS are invited for the position of First Assistant District Engineer in the Cardiff District of the Cardiff and East Central Area of the Board.

The salary for the position will be in accordance with Class H, Grade 4 (£1,270/£1,360) of the National Joint Board Agreement for the Electricity Supply Industry. At the present rate of progress, there are prospects that the classification of this District will be Class J in the not too distant future.

Applications should preferably be Chartered Electrical Engineers with experience in large Districts combining industrial domestic and commercial loads on overhead and underground networks. They should be familiar with the problems of extensive reinforcement, planning and voltage standardization.

Applications, stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, ASSOC. I.E.E., 445/447 Cowbridge Rd East, Cardiff, so as to reach him not later than Saturday, 26 March, 1960. (P 383)

ADMINISTRATIVE COUNTY OF LEICESTER

ASSISTANT ELECTRICAL ENGINEER

£780 to £1,070 according to qualifications. Candidates should be in possession of the Higher National Certificate in Electrical Engineering and be capable of preparing schemes for electrical installations in all types of buildings.

Lodging allowance and removal expenses may be paid to married men.

Apply to County Architect, 123 London Rd, Leicester. (P 284)

SIERRA LEONE GOVERNMENT

INSTRUCTOR (TELECOMMUNICATIONS)

REQUIRED by Technical Education Department on contract for three tours of 10/12 months each in first instance. Salary according to age and experience in scale (including Inducement Addition) £966 rising to £1,528 a year. Gratuity at rate of 15% of total salary drawn. Outfit allowance £60. Children's allowance £48 to £288 per year. Liberal leave on full salary. Free passage for Officer, wife and three children under 18 years. Candidates should be between 22 and 45 years of age and must possess C. and G. Full Technological Certificate in Telecommunications specialising in Radio Transmission or similar qualifications with at least five years' practical experience. Experience in Technical Education an advantage. Write to the Crown Agents, 4 Millbank, London S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/50686/EE. (P 384)

NORTHERN RHODESIA GOVERNMENT

SENIOR TECHNICAL ASSISTANTS
(ELECTRICAL)

REQUIRED by Ministry of Transport and Works on agreement for one tour of 36 months in first instance with prospects pensionable employment. Salary scale £1,260 rising to £1,490 a year. Free passages for officer and wife and assistance towards children's passages. Liberal leave on full salary. Candidates, preferably between 30-44 years of age, must possess H.N.C. (Electrical) or equivalent, together with considerable experience of operating 33 kV, 11 kV overhead lines, substations and L.V. network. They must be fully conversant with electrical regulations relating to installation and distribution work and be able to prepare neat, concise and accurate reports. Experience of operating small run-of-the-river hydro-electric station desirable. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/50834/EE. (P 406)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

YORKSHIRE ELECTRICITY BOARD

No. 2 (Huddersfield) Sub-Area

SENIOR ASSISTANT ENGINEER
(OPERATION AND MAINTENANCE)

APPLICANTS should be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications and have extensive experience in the operation and maintenance of overhead and underground transmission and distribution systems and substation plant. The successful applicant will be responsible to the Sub-Area Engineer for all matters concerned with the operation and maintenance of the supply systems throughout the Sub-Area.

Salary: N.J.B., Class K, Grade 4, £1,470 x £35—£1,575 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market St, Huddersfield, not later than 1 April, 1960.

No. 4 (Leeds) Sub-Area

FOURTH ASSISTANT ENGINEER
(COMMERCIAL)
LEEDS

Candidates should preferably be technically trained to H.N.C. standard and have experience in small industrial and commercial applications of electricity. They should be capable of assisting in the general commercial activity of the District including advising consumers on tariffs and the selection and use of electrical apparatus.

Some knowledge of thermal storage heating systems will be an advantage.

Salary: N.J.B., Class K, Grade 12, £860 x £15—£905 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Nr. Leeds, not later than 1 April, 1960.

No. 1 (Bradford) Sub-Area

FOURTH ASSISTANT ENGINEER
(METERS, TESTING AND PROTECTION)

Candidates should hold the Higher National Certificate in Electrical Engineering or an equivalent Technical qualification. They should have some experience in the commissioning of new substations and in routine testing and maintenance of protectective gear. This post may involve a measure of standby availability.

Salary: N.J.B., Class K, Grade 13, £815 x £15—£860 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45/53 Sunbridge Rd, Bradford 1, not later than 1 April, 1960.

No. 5 (Wakefield) Sub-Area

BARNSLEY DISTRICT
ASSISTANT CONSUMERS' ENGINEER

This post offers an opening for a young man with the technical standard of the Ordinary National Certificate in Electrical Engineering, who has preferably already had some training in installation work. He will be given training in the various aspects of Commercial Work in the District dealing with new and increased supplies to small industrial and commercial consumers, street lighting negotiations and tariff queries. He will initially be required to supervise the Installation Inspectors and to render general assistance to the Consumers' Engineer.

Salary: N.J.B., Class H, Grade 13, £710 x £15—£755 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 1 April, 1960.

No. 6 (Hull) Sub-Area

ENGINEERING DRAUGHTSMAN
(BUILDING AND CIVIL)

Applicants should have had a good general and technical education. The successful candidate will be required to prepare drawings of substations, offices, building alterations, etc., and should have had experience in the design of buildings and in civil engineering work.

continued in next column

continued from previous column

Salary: N.J.B., Schedule D, Grade 6, £620 x £20—£740 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 1 April, 1960. (P 419)

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointment in the Divisional Electrical Department:

FOURTH ASSISTANT ENGINEER
FINCHLEY (EAST) TECHNICAL SECTION

Salary: N.J.B., Class AX/DX, Grade 8, £735 x £25—£860/£935 per annum plus London Weighting.

Previous experience in the commissioning of high voltage electrical apparatus and associated protective gear would be an advantage.

Applicants should possess a Higher National Certificate in electrical engineering or its equivalent.

The applicant appointed will be required to reside in the South East Essex Area.

Applications, quoting Staff Vacancy No. 1310, stating age, qualifications, experience and present position should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 26 March, 1960. (P 410)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

CONWAY VALLEY DISTRICT

North Wales

AN opportunity for the right men to work and live on the beautiful North Wales Coast.

POST A—CONSUMERS' ENGINEER

required to direct the Commercial activities in a Sub-District covering a delightful rural and coastal area with Service Centre and Offices in the Borough of Conway.

An excellent four-bedroomed flat in Llandudno may be offered to the successful applicant, who must have had a sound technical training and experience within the Industry in dealing with—

(a) Designing and estimating for all types of electrical installation work.
(b) Advising consumers on tariffs, appliances and all aspects of utilisation of electricity.
(c) Organisation of Service Centres and Exhibitions.
(d) Control of manual and administrative staff.

Salary within range £815/£860 per annum (N.J.B. E/8).

POST B—ASSISTANT CONSUMERS ENGINEER

required, to be based at Colwyn Bay—a popular coastal holiday resort.

Applicants must have some technical training, and be experienced in and capable of dealing with—

(a) Preparing estimates and specifications for all types of contracting work.
(b) Supervision of contracting staff.
(c) Advising consumers on electricity utilisation and tariffs.

Salary within range £560/£605 per annum (N.J.B., E/13).

Both above appointments subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity Hse, Rhostyllen, nr. Wrexham. Closing date: 29 March, 1960. (P 412)

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointment:

FOURTH ASSISTANT ENGINEER
(RESEARCH AND SPECIAL TESTING)
ELECTRICAL DEPARTMENT
DIVISIONAL HEADQUARTERS
(COCKFOSTERS)

Salary: N.J.B., Class AX/DX, Grade 7, £840 x £25—£965/£1,040 per annum, plus London Weighting.

Applicants should possess qualifications necessary for Graduate Membership of the Institution of Electrical Engineers. The successful applicant will be required to assist in applied research and special testing concerning electrical plant in high voltage switching, transforming and generating stations. Electrical measurement and electronic experience is desirable.

Applications, quoting Staff Vacancy No. 1306, stating age, qualifications, experience and present position should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, by 26 March, 1960. (P 398)

UNIVERSITY OF LONDON

DEPUTY ENGINEER

SENATE House. Applications are invited from professionally qualified Engineers with practical experience in the control of staffs and the maintenance of large-scale heating, and electrical installations for the post of Deputy Engineer located at Senate House, Bloomsbury. He will be responsible to the Resident Engineer for the provision and supervision of all engineering services for the developing Bloomsbury site, including direct electric, oil-fired and thermal storage heating installations, ventilation and air conditioning plant. Present salary scale £900 x £50—£1,200. Starting point according to age and experience, with generous leave, superannuation and family allowances. Applications stating full details of training and experience by 30 April, 1960, to the Maintenance Officer, University of London, Senate Hse, W.C.1, from whom further particulars may be obtained. (P 388)

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are subject to N.J.B. Agreement for the Electricity Supply Industry.

1. Area Board Headquarters

ONE SENIOR DRAUGHTSMAN

Chief Engineer's Department, Drawing Office, with location at Carliol Hse, Newcastle upon Tyne.

Applicants should have experience in preparation of schematic and electrical layout drawings for proposed 132 kV substations and the preparation of route plans for 132 kV overhead lines. Knowledge of building construction will be an advantage.

Candidates should be neat and capable draughtsmen and possess Ordinary National Certificate in Electrical Engineering or some equivalent qualification.

Salary: Schedule D, Grade 5, £790/£890.

2. Wear Sub-Area

ONE THIRD ASSISTANT DISTRICT ENGINEER

with location at Hesledon District.

Applicants should have practical training and experience in construction, operation and maintenance of H.V., M.V. and L.V. overhead and underground networks and associated plant and equipment. Preference will be given to candidates holding Higher National Certificate or Higher National Diploma in Electrical Engineering or higher qualification.

Housing accommodation can be offered to successful candidate.

Salary: Schedule A, Class F, Grade 9, £815/£860.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, GPO Box No. 117, Carliol Hse, Newcastle upon Tyne 1, within 10 days of the appearance of this advertisement. (P 421)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Worcester and District Sub-Area

SECOND ASSISTANT ENGINEER
(OPERATIONS)
(PLANNING AND OPERATIONS SECTION)
(HEADQUARTERS)

Duties will include the operation of extensive 66, 33, 11 and 6·6 kV systems in a predominantly rural area, system loadings, fault level calculations, protective gear settings and responsibility for the Sub-Area Control Centre. Technical qualifications desirable. Salary: £1,195/£1,270 per annum (N.J.B. Grade K.7).

THIRD ASSISTANT ENGINEER (CIVIL)
(BUILDING SECTION) (HEADQUARTERS)

Duties will include the design and supervision of alterations to Service Centres, civil works and switch houses associated with 66 and 33 kV outdoor substations. Knowledge of modern building methods essential. Technical qualifications desirable. Salary: £965/£1,025 per annum (N.J.B. Grade K.10).

SECOND ASSISTANT DISTRICT ENGINEER
(STRATFORD)

Duties will include assistance in the construction, operation and maintenance of H.V. and M.V. overhead and underground mains and substations, and in the planning of system reinforcement and extensions. Technical qualifications desirable. Salary: £860/£905 per anum (N.J.B. Grade E.7).

Apply, by letter, within 14 days, stating age, qualifications, experience, present position and salary, to Mr R. Mallet, Sub-Area Manager, Midlands Electricity Board, P.O. Box 52, Blackpole Rd, Worcester.

F. W. CATER,
Secretary.
(P 404)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

FOURTH ASSISTANT ENGINEER
TRANSMISSION DEPARTMENT
DIVISIONAL HEADQUARTERS
Vacancy No. 47/60.

Experience in maintenance and operation of 132 kV Transmission Lines and Substations essential. Candidates should preferably have qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 7 (£840/£1,065 per annum), of Schedule B of the National Joint Board Agreement.

Closing date for receipt of applications: 25 March, 1960.

FOURTH ASSISTANT ENGINEER
COVENTRY SECTION
Vacancy No. 54/60.

Applicants should have experience of maintenance and operation of E.H.T. overhead lines, transformers and switchgear. Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£735/£960 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 25 March, 1960.

SHIFT CHARGE ENGINEERS
WILLINGTON "A" POWER STATION
Vacancy No. 59/60.

Candidates should have had a sound technical training and considerable experience in a modern power station. Preference will be given to candidates who are Graduate Members of the Institution of Electrical or Mechanical Engineers, or who hold similar qualifications, and knowledge of pulverised fuel firing will be an advantage.

Salary will be in accordance with Class L, Grade 6 (£1,360/£1,450 per annum), of the

continued in next column

continued from previous column

National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 1 April, 1960.

SENIOR DRAUGHTSMAN
(CIVIL ENGINEERING AND BUILDING)
TRANSMISSION DEPARTMENT
DIVISIONAL HEADQUARTERS
Vacancy No. 60/60.

Applicants for this appointment must have suitable technical training and be thoroughly conversant with the design and detailing for civil and building works, including steel and R.C. structures and foundations. The work is associated with H.V. Substations and Generating Stations.

Salary will be in accordance with Grade 4 of Schedule D of the National Joint Board Agreement and will be within the range £930/£1,030 per annum.

Closing date for receipt of applications: 1 April, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated.

O. S. WOODS,
Divisional Controller.
9 March, 1960. (P 401)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER
(MAINTENANCE AND OPERATION)

PORTSMOUTH District of No. 3 (Portsmouth) Sub-Area. Salary: N.J.B., Class H, Grade 9 (£910 x £15—£955 per annum). N.J.B. Conditions of Service.

The successful candidate will be required to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations, and with minor construction work. Applicants should have had sound experience in electricity supply distribution and the possession of suitable technical qualifications will be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1177, not later than 28 March, 1960.

ASSISTANT ENGINEERS
(MAINTENANCE AND OPERATION)
(FOUR VACANCIES)

Portsmouth District of No. 3 (Portsmouth) Sub-Area. Salary in each case: Class H, Grade 10 (£860 x £15—£905 per annum). N.J.B. Conditions of Service.

The duties of the posts will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1178, not later than 28 March, 1960.

ASSISTANT ENGINEER (PLANNING)

Oxford District of No. 2 (Newbury) Sub-Area. Salary: N.J.B., Class J, Grade 11 (£860 x £15—£905 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks, and to undertake standby duties if required. Applicants should possess suitable technical qualifications.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1179, not later than 28 March, 1960.

continued in next column

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ASSISTANT ENGINEER
(MAINTENANCE AND OPERATION)

Greenford District of No. 1 (Southall) Sub-Area. Salary: N.J.B., Class G, Grade 10 (£815 x £15—£860 per annum, plus London Allowance of £50). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance and operation of switchgear, transformers, cables and overhead lines up to and including 11 kV. The appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, 2/6 Windmill La, Southall, Middlesex, and returned to him, quoting Z.1110, not later than 28 March, 1960.

INSTALLATION ASSISTANT

Melksham District of No. 2 (Newbury) Sub-Area, located at Chippenham. Salary: N.J.B., Class G, Grade 11 (£765 x £15—£810 per annum). N.J.B. Conditions of Service.

Applicants should have had experience in the preparation of specifications and estimates for all types of electrical wiring installations. They should be competent to supervise Electricians and organise the allocation of work.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1176, not later than 28 March, 1960.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (P 420)

METROPOLITAN BOROUGH OF FULHAM

Borough Engineer & Surveyor's Department

ELECTRICAL ENGINEERING ASSISTANT

A.P.T. I, £610/£765; A.P.T. II, £765/£880; or N.J.C. Special Scale, £785/£1,070 plus £20/£30 per annum London Weighting. Commencing according to qualifications and experience. A candidate appointed in A.P.T. I or II can progress to N.J.C. Special Scale when sufficiently qualified and experienced. Experience in the design and installation of street lighting essential and good general experience of electrical installations is also required. Membership of I.E.E., A.P.L.E. or I.E.S. an advantage. Details from Town Clerk, Town Hall, S.W.6. Closing date 31 March. (P 427)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS' ENGINEER

REQUIRED in the Warrington District of the Board's No. 2 Sub-Area. Salary within range £765/£810 per annum (N.J.B., G/11).

Duties will include estimating for contracting work and advising consumers on matters relating to electricity supply and the utilisation of electrical equipment. Technical qualifications desirable.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, Northwich, Cheshire. Closing date: 29 March, 1960. (P 417)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

THIRD ASSISTANT COMMERCIAL ENGINEER

REQUIRED at No. 3 Sub-Area Headquarters, Chester. Salary: £965/£1,025 per annum (N.J.B., K/10).

Applicants should preferably have had technical training and experience in electrical load development for industrial, commercial, rural and domestic premises.

Appointment subject to medical examination. Pension Scheme.

Forms of application, obtainable from the Manager, No. 3 Sub-Area, Electricity Hse, Newgate St, Chester, should be returned not later than 2 April, 1960.

(P 422)

South Western ELECTRICITY

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following positions:

SECOND ASSISTANT DISTRICT ENGINEER (PROTECTION)
BRISTOL

Salary within Class K, Grade 7, £1,195 x £25—£1,270 per annum—of the N.J.B. Agreement.

The successful candidate should have extensive experience in distribution protection practice, commissioning procedure and routine testing of unit protection systems.

Experience in system operation and a sound knowledge of plant performance is essential. Corporate membership of the Institution of Electrical Engineers is desirable.

Applications to be made on Standard Form AE6/ACT obtainable by postcard only from the District Manager, South Western Electricity Board, Electricity Hse, Colston Ave, Bristol, 1. Closing date for receipt of completed applications is 2 April, 1960.

THIRD ASSISTANT ENGINEER (PLANNING)
CHIEF ENGINEER'S DEPARTMENT
HEAD OFFICE

Salary according to Class AX, Grade 6 —£925 x £25—£1,050 per annum—of the N.J.B. Agreement, with further progression to £1,140 (Class DX).

Duties will include the preparation and technical assessment of reinforcement and development schemes for the Board's E.H.V., H.V. and L.V. systems, the preparation of Finance Committee Board Papers, assistance with the Capital Budget programme, the examination of load flow diagrams and estimation of future trends, and the preparation of schemes for long-term reinforcement.

Applicants should be either engineering graduates or have passed the Higher National Certificate in Electrical Engineering, and should have had some experience of the construction, operation and maintenance of distribution equipment.

Applications to be made on Standard Form AE6/ACT obtainable by postcard only from the Establishments Officer, South Western Electricity Board, Electricity Hse, Colston Ave, Bristol 1. Closing date for receipt of completed applications is 2 April, 1960. (P 411)

ASSISTANT required London Electrical Contractors. Must have drawing office and estimating experience. Write stating age, experience and salary.—Box No. 7785, Electrical Times. (P 395)

ELECTRICAL ENGINEER

required for a large new factory in

NORTHERN IRELAND

to take charge of electrical and instrument maintenance

Several years' experience in the maintenance of chemical or allied factories is required, together with practical experience in H.T. and L.T. distribution and preferably including instrument maintenance. A degree in electrical engineering and/or corporate membership of the Institution of Electrical Engineers desirable.

Age range 30-45. The position is pensionable and gives progressive opportunities. Assistance on housing if necessary.

Apply, Box No. 7787 Electrical Times
(P 413)

BRITISH RAILWAYS

ELECTRICAL FITTERS REQUIRED

Vacancies exist for Fitters for the maintenance of electrical and maintenance equipment on the electrical rolling stock maintained at Ilford for operation on the Eastern Region Electrified Lines in the London Area. Applicants must have served a recognised apprenticeship and possess some electrical knowledge. Rate of pay is 186s 6d per week of 44 hours plus bonus or piecework according to work involved. Vacancies exist:

(a) In Repair Shop on regular day shift where average earnings for last three months have varied between £13 and £15 per week.

(b) In Inspection Shed involving shift working where earnings over last three months have been £16 18s per week.

Successful applicants must pass medical examination. Certain free and reduced rate rail travel facilities. Pension and Sick Pay Schemes.

Apply in writing giving details of age, experience, etc., to

Electric Traction Engineer
(London Area),
British Railways, Eastern Region,
Off Ley Street,
Ilford, Essex. (P 429)

ASSISTANT to Manager of Invoicing Department required for Group of Wholesaling Companies in electrical industry. Knowledge of electrical trade essential. Excellent salary and prospects for suitable applicant. Superannuation and bonus schemes.—Write to Box 7791, Electrical Times. (P 433)

ASSISTANT ELECTRICAL ENGINEER for large Continental manufacturers' London office, handling tenders and orders for induction heating plant. Salary and commission basis plus travelling expenses. Some knowledge of French. Car owner preferred.—Box No. 7793, Electrical Times. (P 396)

BRITISH RAILWAYS

LONDON MIDLAND REGION
EUSTON

LIGHTING AND ELECTRICAL SERVICES ENGINEER

A vacancy exists at Euston for a Lighting and Electrical Services Engineer with experience in design of modern lighting installations and layout of electrical services in large office and industrial buildings.

Salary range: £1,095/£1,200 per annum.

Five-day week, concessionary rail travel and Superannuation Fund.

Applications in writing quoting reference No. 98 and stating qualifications, age and experience to:

A. N. Butland,
O.B.E., B.A., B.SC.(ENG.), M.I.C.E.
Chief Civil Engineer,
British Railways,
London Midland Region,
5a Euston Grove,
London N.W.1
(P 403)

ELECTRICAL ENGINEERING ASSISTANT, to work with Engineer preparing drawings and specifications for installations on industrial and commercial buildings generally. Write stating age, experience and qualifications to.—L. J. Schwarz and Partners, Eagle Hse, High St, Wimbledon, S.W.19. (P 381)

ELECTRICAL ENGINEER required for Glasgow Office staff. Applicants should have completed post graduate training in manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (P 431)

ELECTRICAL ENGINEERS
DESIGN DRAUGHTSMEN

Applications are invited from qualified Electrical Engineers and Design Draughtsmen to work on nuclear and special engineering development projects in the fields of power distribution and automatic control. The positions are permanent and pensionable and offer a progressive career with the Company.

The Offices occupy pleasant accommodation in a modern building adjacent to Paddington Station.

If you would like to discuss these vacancies with us, please write giving full details of experience, age, etc., to:

The Office Manager,

JOHN BROWN (S.E.N.D.) LIMITED,

20 Eastbourne Terrace,

London, W.2.

(P 409)

ROLLS-ROYCE
LIMITED

ELECTRICITY MAINS ENGINEER

A vacancy exists for the above post operating and maintaining a large 11 kV network at their Spadeadam Rocket Establishment, Nr. Carlisle. Applicants must have had a sound engineering training and several years' experience with H.V. systems, including the testing and operation of protective gear, switchgear and overhead lines maintenance, fault location and the operation of a permit to work system. The possession of technical qualifications to H.N.C. (Electrical) standard is desirable.

The post is pensionable and housing accommodation is available.

Salary will be in accordance with qualifications and experience. Applications stating age, experience and qualifications should be addressed to:

The Administration Officer,
ROLLS-ROYCE LIMITED,
Spadeadam Rocket Establishment,
Nr. Gilsland,
CUMBERLAND

(P 392)

FOREMEN and LEADING ELECTRICIANS required immediately with overseas experience for dockyard installation and underground distribution, Tema Harbour, Ghana.—Apply with photograph, credentials and experience to Aish and Co. Ltd., Vanguard Wks, Poole, Dorset. (P 393)

ELECTRICAL DESIGN ENGINEER

A Graduate is required for the position of Electrical Design Engineer at this fully integrated Iron and Steel Works situated on the West Coast of Cumberland.
The work is extremely varied ranging from High Voltage Power to Control Engineering.
Good Life Assurance and Contributory Pension Scheme.

Applicants, who should have had practical experience subsequent to a recognised training scheme, should write to The Secretary, Workington Iron and Steel Co. (a Branch of The United Steel Cos. Ltd.), Moss Bay, Workington, Cumberland. (P 430)

J. & P. CAPACITOR DEPARTMENT

Johnson and Phillips Ltd. have a vacancy in their Capacitor Department—Test Section—for a YOUNG MAN holding H.N.C. Good opportunity for a progressive man to work in a modern well equipped factory. Excellent canteen facilities, pension scheme, etc. Applications giving full particulars of training and experience together with age to: Employment Manager, Johnson and Phillips Ltd., Charlton, London S.E.7. (P 269)

LIGHTING FITTINGS DESIGN.—Versatile Designer/Draughtsman with practical knowledge of manufacturing technique required for drawing office of old-established company in Central London. Diverse range of industrial, commercial and specialised equipment. Contributory pension scheme.—Box No. 7755, Electrical Times. (P 264)

WIMPEY

Applications are invited from

ELECTRICAL ENGINEERS

who are seeking permanent, progressive and interesting appointments on Construction sites, both at home and abroad.

Applicants should have experience in Refineries, Power Stations, Pulp and Paper Mills, Steel Works, or Hydro-Electric installations.

Written applications, giving details of age, qualifications and experience, to:

GEORGE WIMPEY AND CO. LTD.,
27 Hammersmith Grove,
London W.6.

Ref. 913.F.

(P 385)

A SENIOR CONTROL GEAR ENGINEER

is Required by an Old Established Company of Control Gear Manufacturers near London.

A top rate salary and good prospects await a really experienced and qualified man of good personality, who is required to take a leading position in the Company's Engineering Department.

A knowledge of feed-back systems is desirable but not essential.

All information will be treated in the strictest confidence by The Secretary, Box No. 7767, Electrical Times.

(P 318)

ELECTRICAL ENGINEERING.—An engineer and assistant design engineers are required by the United Kingdom Atomic Energy Authority at Risley to work in a team responsible for the design of electrical installations in chemical and allied buildings and power reactors. The engineer will be responsible to a senior engineer for organising and controlling the work of assistant design enginers and draughtsmen employed in the team.

All applicants must have served a recognised engineering apprenticeship or have had comparable training and preferably have experience of electrical control circuits on automatic control gear.

Applicants for the engineer post must be corporate members of the Institution of Electrical Engineers or equivalent and have wide experience of a similar type of work. An appropriate university degree is desirable. Applicants for the assistant design engineer posts must possess an appropriate degree or H.N.C. and have several years' design or drawing office experience.

Salaries will be between £1,370 and £1,825 for the engineer and between £930 and £1,340 for the assistant design engineers.

Contributory superannuation. Staff housing scheme.

Send postcard for application form, quoting reference 192/J.8, to Recruitment Officer, U.K.A.E.A., Development and Engineering Group Headquarters, Risley, Warrington, Lancashire.

Closing date: 28 March, 1960. (P 386)

ELECTRICAL—TECHNICAL ASSISTANT to Manager of Electrical Contractors engaged on installation contracts for large office blocks, schools, flats and industrial buildings. Technical trained with drawing office experience. Pension Scheme, progressive salary with excellent prospects for suitable applicant, aged 23-38. State age, experience, present salary.—Box No. 7771, Electrical Times. (P 332)

CABLE ENGINEER

A senior appointment is open for a fully qualified Cable Engineer with wide experience in the design, manufacture and testing of all types of Electric Cables.

Good prospects for a suitable applicant. Pension and Life Assurance Scheme in operation.

Write, stating age, qualifications, experience and salary required to Box No. 7777, Electrical Times. (P 370)

AEI

ASSOCIATED ELECTRICAL INDUSTRIES LIMITED

Turbine-Generator Division

SENIOR SALES AND CONTRACTS ENGINEERS

EXPANSION has caused vacancies in the large Steam Turbine Sales Department at Trafford Park, Manchester, for suitably qualified men with ambition and initiative for interesting and progressive positions.

The desirable qualifications are a Degree or Higher National Certificate in Mechanical or Electrical Engineering and experience in either the design, construction, operation or testing of Turbine-Generators and associated equipment.

Some commercial experience would be an advantage as the successful applicants will prepare tenders at Trafford Park and after suitable experience will have the opportunity of negotiating with Purchasers' Engineers overseas.

A good salary commensurate with qualifications and experience is offered.

Please write for application form quoting reference W.14 to:

Personnel Manager,
ASSOCIATED ELECTRICAL INDUSTRIES (MANCHESTER) LIMITED,
Trafford Park,
MANCHESTER, 17

(P 390)

EXCELLENT opportunity exists with well-known electrical manufacturers in the West London Area for a YOUNG ENGINEER, aged 25-29, for Technical Sales Development duties. Education to G.C.E. standard essential and knowledge of electric furnaces desirable. Salary will be according to age and experience; superannuation and bonus schemes in operation. Saturday interview arranged if required.—Write in confidence with full details of age, education and experience to Box No. 7789, Electrical Times. (P 432)

ELECTRICAL ENGINEERS.—G.E.C. Overseas Services Ltd., a subsidiary of G.E.C., has a number of vacancies for qualified engineers. The Company is divided into two main sections: 1, Dealing with complete electrical installations in a wide variety of buildings and calling for previous contracting experience; 2, specialising in airfield electrification including H.T. and L.T. distribution, stand-by generating equipment, airfield lighting and remote control equipment. Apply in writing, quoting ref. B.D., to the Staff Manager, G.E.C., Magnet Hse, Kingsway, W.C.2. (P 394)

HARTLEY ELECTROMOTIVES LTD., SHREWSBURY, require the services of ELECTRICAL ESTIMATOR or ELECTRICIAN willing to train for this progressive position. Good salary dependent on experience, staff privileges, modern office with ideal working conditions. Pension Scheme. Housing assistance if required. Apply: General Manager, Wiring Systems Division. (P 286)

ELECTRICAL CONTRACTORS require an estimator for industrial and commercial installations. Only fully experienced men who are conversant with all types (including FLP) need apply.—Please write stating experience, qualifications and salary required to Box No. 7753, Electrical Times. (P 263)

FOTHERGILL & HARVEY LIMITED
Littleborough
Lancs.

Require an energetic and enthusiastic representative to develop the sale of their P.T.F.E. coated material and fabrics.

Established contacts with the Electrical Industry are essential and some background knowledge of electrical theory and practice is necessary to supply technical assistance to the existing sales force.

Good income, with contributory pension scheme, is assured and a car will also be provided. Apply giving full details of age and experience to The Personnel Officer, Sladen Wood Mill, Littleborough, Lancs. (P 369)

DESIGN AND DEVELOPMENT
of
POWER TRANSFORMERS
with
'ENGLISH ELECTRIC'
STAFFORD

Production expansion gives rise to a number of professional engineering appointments in the heavy transformer design and development group.

The department covers the range of power transformers 30 MVA-300 MVA, heavy duty rectifier transformers, power system chokes and reactors, including mechanical and auxiliary equipment.

The more senior appointments in this field necessitate previous design experience, though more junior qualified engineers interested in this class of work are also invited to apply particularly with regard to the experimental development work.

If you would like to visit Stafford to discuss these openings, please write giving full details to Dept. C.P.S., Marconi Hse, 336/7 Strand, London W.C.2, quoting reference ET 1296F.

(P 387)

SENIOR DRAUGHTSMEN

capable of checking, required for the design of complete electrical installations for Oil Refineries and Chemical Plants. Essential to have experience in design on large industrial contracts. Pension and Life Assurance Scheme. Apply in writing stating age, qualifications and experience, to Foster Wheeler Ltd., 3 Ixworth Pl, London S.W.3.

(P 327)

REQUIRED by Siemens-Schuckert (Great Britain) Ltd., Faraday Works, Great West Rd, Brentford. ELECTRICAL and/or MECHANICAL DRAUGHTSMEN for the Industrial Switchgear and the Resistance Welding departments. Experience in these products desirable but not essential.

Junior Engineers for the Industrial Switchgear and the Flameproof Switchgear departments.—Write to Technical Director. (P 330)

SOUTHERN IRELAND—WORKS ENGINEER required by large city factory. The Works Engineer will be responsible to the Works Manager for the maintenance of plant and buildings, and supervision of a small drawing office and workshop. This appointment offers considerable variety and experience, and calls for an imaginative man, preferably with a flair for design and electrical work. The broad requirements are a Mechanical or Electrical Engineering Degree, or membership of I.E.E. or I.Mech.E., with considerable experience. Age 25 to 35. Commencing salary £800/£1,100 p.a., depending on experience. Contributory pension scheme. Apply with full details of education, qualifications and career in strict confidence to Managing Director.—Box No. 7769, Electrical Times. (P 331)

STOREKEEPER required, only first-class applicants with substantial experience in electrical wholesaling will be considered. More than average salary is offered in return for ability and efficiency. Permanent superannuated post for right man desirous of progress. Canteen available.—Halsey's, Fulham 3355. (P 380)

TELEPHONE ENGINEER wanted for South America. Must be efficient automatic telephone engineer, with PAB-X experience and capable of maintaining electrical and outside plants. Administrative experience desired. Apply giving full particulars of experience, age, etc..—Box No. A621, c/o Walter Judd Ltd., 47 Gresham St, E.C.2. (P 407)

BUSINESS OPPORTUNITIES

ELECTRICAL WHOLESALER in West Riding of Yorkshire with small growing business wishes to amalgamate with large wholesale concern with a view to ultimate sale. All enquiries treated in strictest confidence.—Box No. 7775, Electrical Times. (P 334)

PROGRESSIVE and expanding Electrical Company with small South Coast factory needs additional DIRECTORS, both technical and sales. Investment of £2,000/£3,000 preferred. Write, Secretary, J. Bull Electrical Ltd., Sutton Rd, Eastbourne. (P 217)

AGENCIES

WELL - KNOWN and old - established Electrical Appliance Manufacturer requires EXPERIENCED REPRESENTATIVE with contacts with Electrical Wholesalers and Boards for South London and South East England. Good salary and modern car provided.—Box No. 7781, Electrical Times. (P 372)

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PATENTS

THE Proprietor of British Patent No. 616017, entitled "INSULATOR AND HERMETIC SEAL FOR THE EXPOSED ENDS OF ELECTRIC TERMINALS," offers same for licence or otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Stern and Carlberg, 14 E. Jackson Blvd, Chicago 4, Illinois, U.S.A. (P 348)

THE Proprietor of British Patent No. 767,470 for "IMPROVEMENTS IN AND CONNECTED WITH ELECTRIC BATTERIES," desires to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder.—Further particulars may be obtained from Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London W.C.2. (P 434)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (P 1)

20 KVA METRO-VICK ALTERNATORS, 1,000 r.p.m., as removed from Lister four-cylinder ex W.D. sets.—Box No. 7773, Electrical Times. (P 333)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service, fully guaranteed. Edgware 5566 (4 lines). — Service Electric Co. Ltd., Stanmore, Middx. (P 2)

FOR SALE

YORKSHIRE ELECTRICITY BOARD
No. 3 (SHEFFIELD) SUB-AREA
Surplus Workable Plant

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Offers, in accordance with the Board's Special Conditions relating to the disposal of Surplus Plant, which may be obtained on request from The Manager, No. 3 (Sheffield) Sub-Area, Commercial St, Sheffield 1, must be received not later than 10 a.m. on Monday, 28 March, 1960. (P 437)

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co. Ltd., Honeypot La, Stanmore, Middx. Edgware 5566/9. (P 4)

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi 5105, 67 Rothschild Rd, W.4. (P 3)

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A.C. and D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½—100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton. Elmbridge 2234/5/6. (P 9)

HEWITTIC MERCURY RECTIFIER.—Input 4,000 A.V. 3-ph. 50 amps. Output 100-115 V d.c. at 90 amps.—Offers to Regent Cinema, Shirley, Southampton. (P 397)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment.—Universal Electrical, 221 City Rd, London, E.C.1. (P 5)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (P 8)

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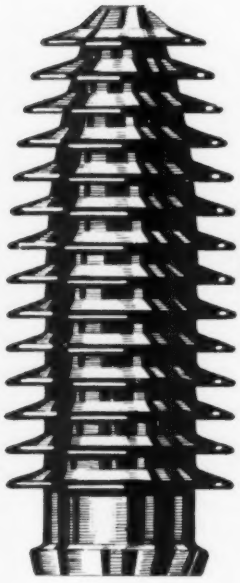

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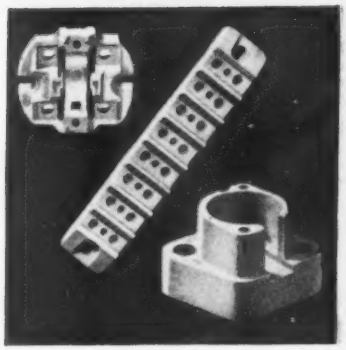

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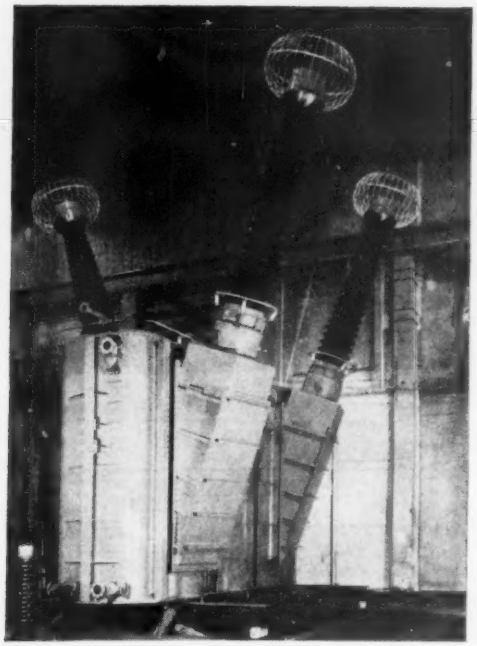

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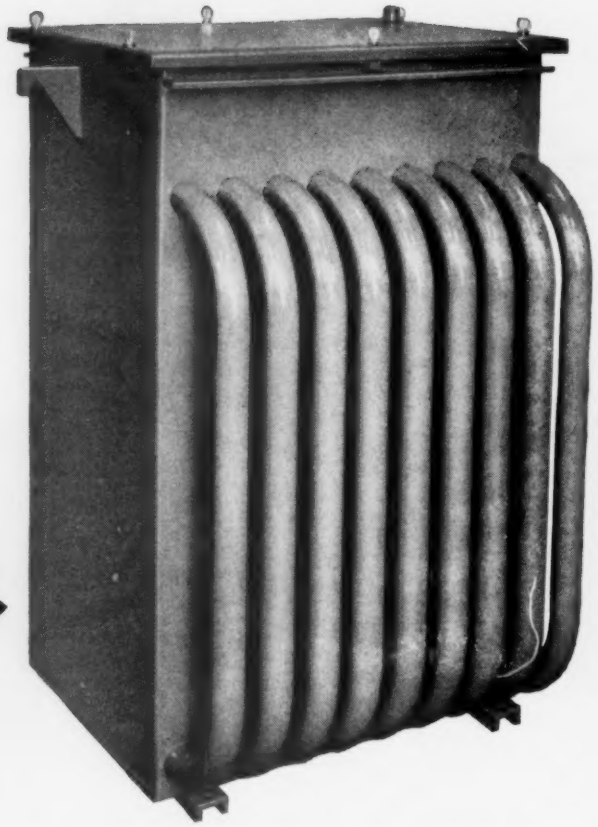

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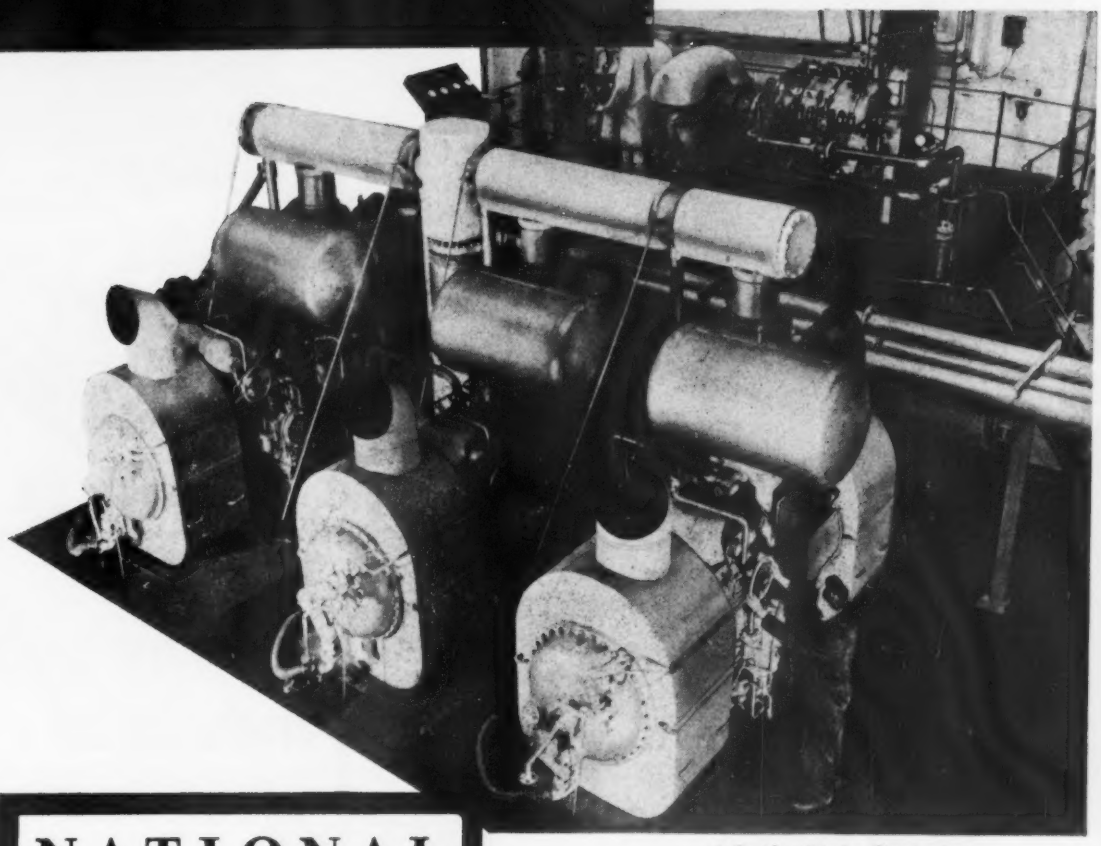

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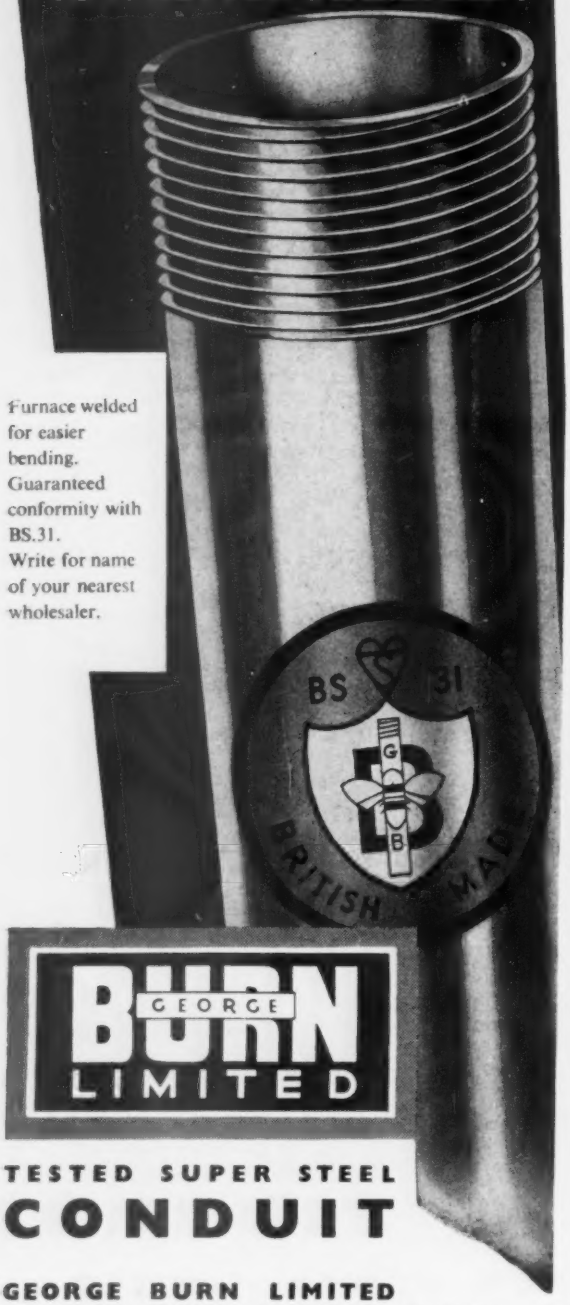

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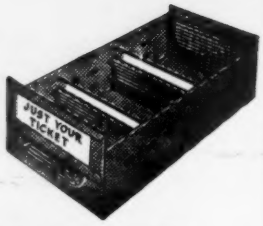

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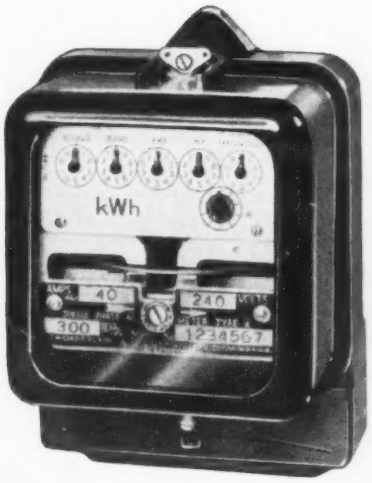

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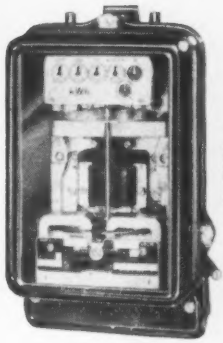

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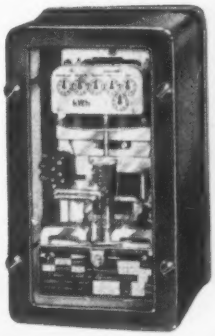

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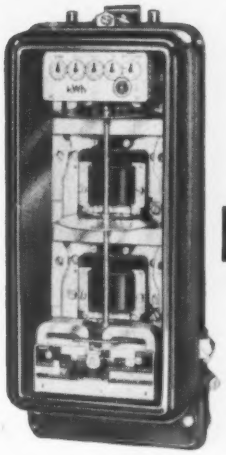

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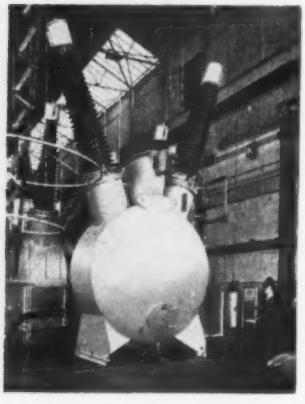

The illustrations show a complete 330 kV. bushing insulator and a 330 kV. circuit breaker, by courtesy of AEI Ltd.

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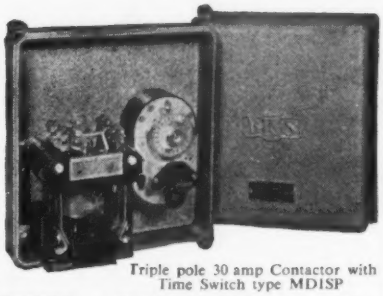

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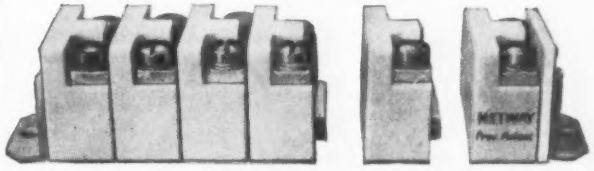

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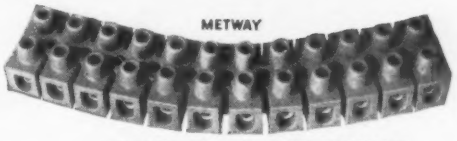

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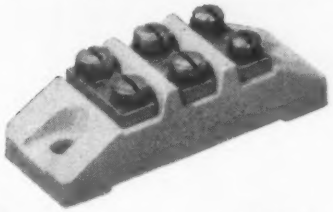

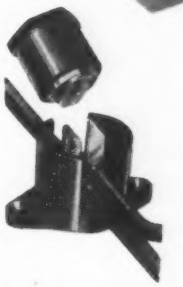

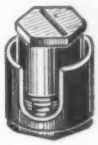

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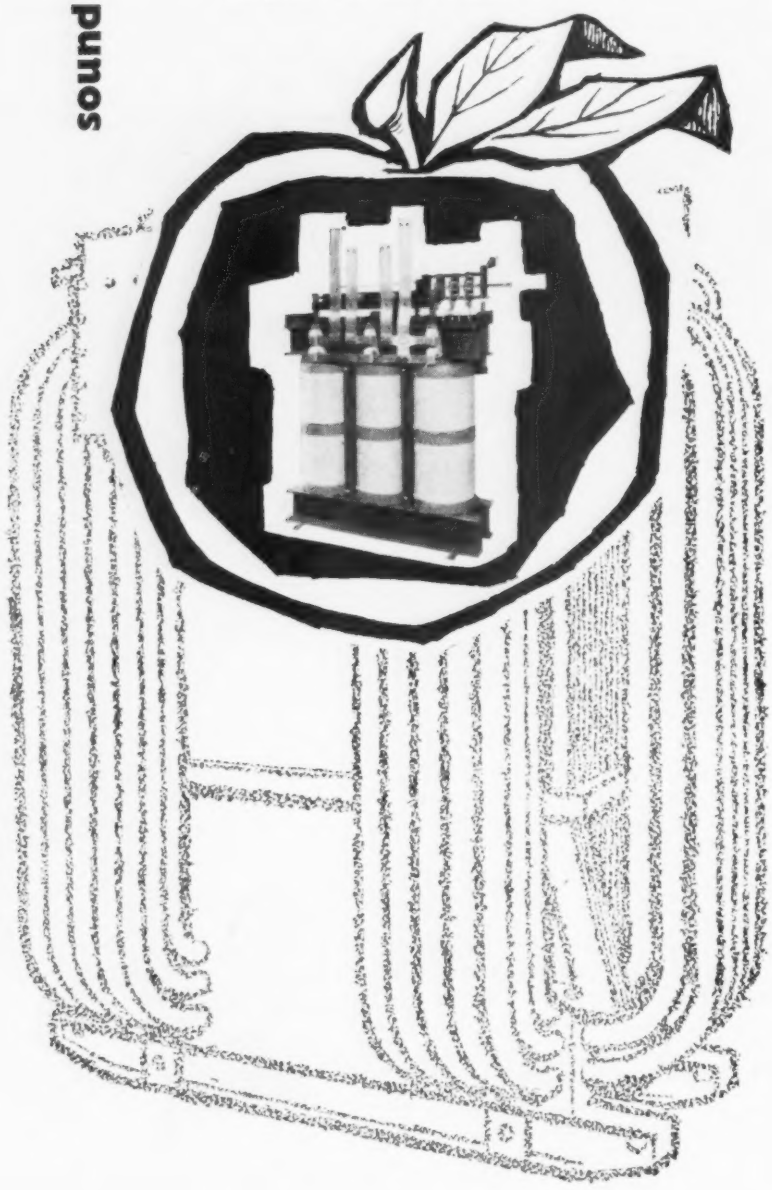

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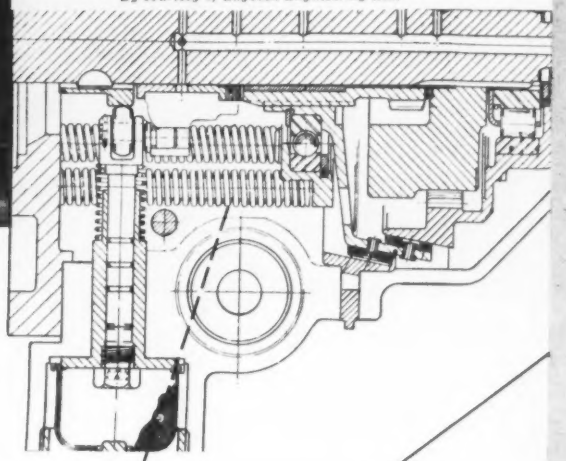

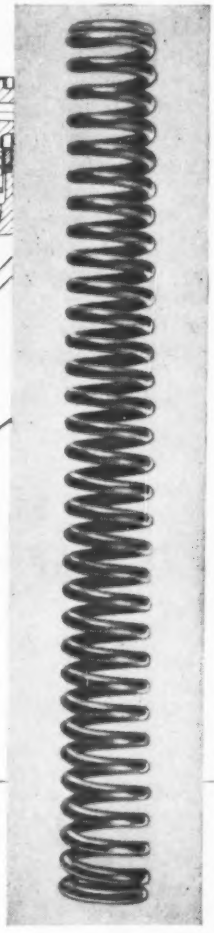

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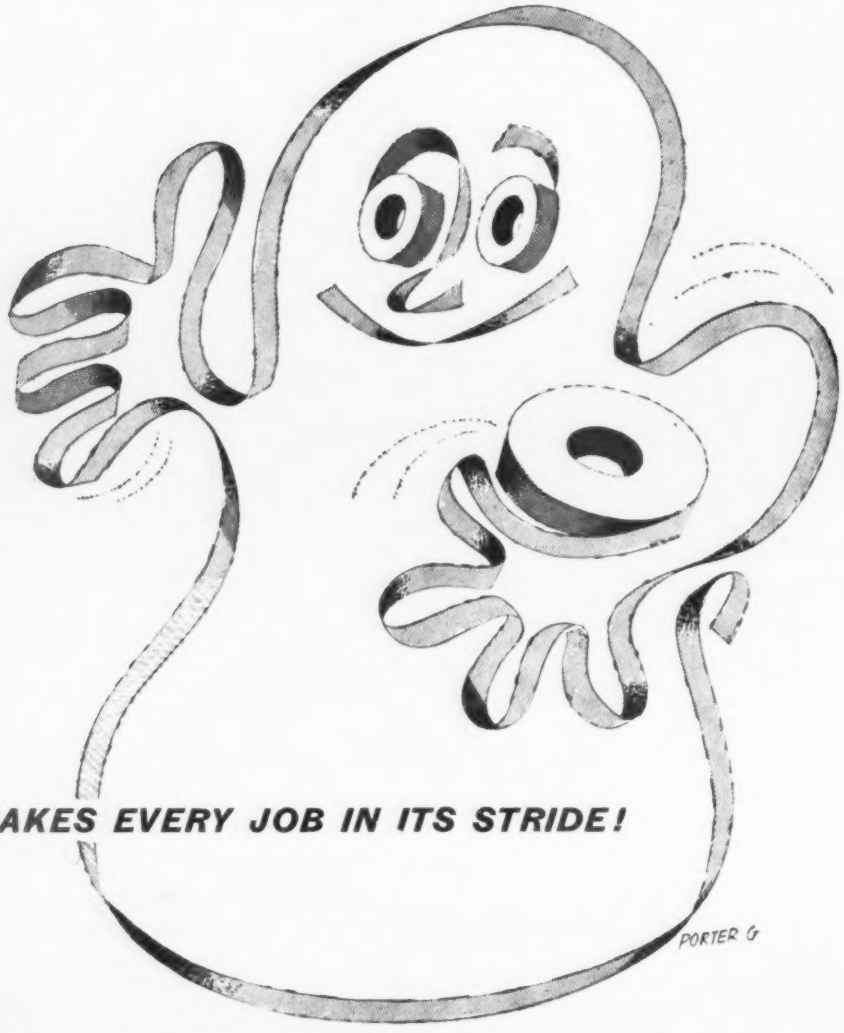

YET IT TAKES EVERY JOB IN ITS STRIDE!

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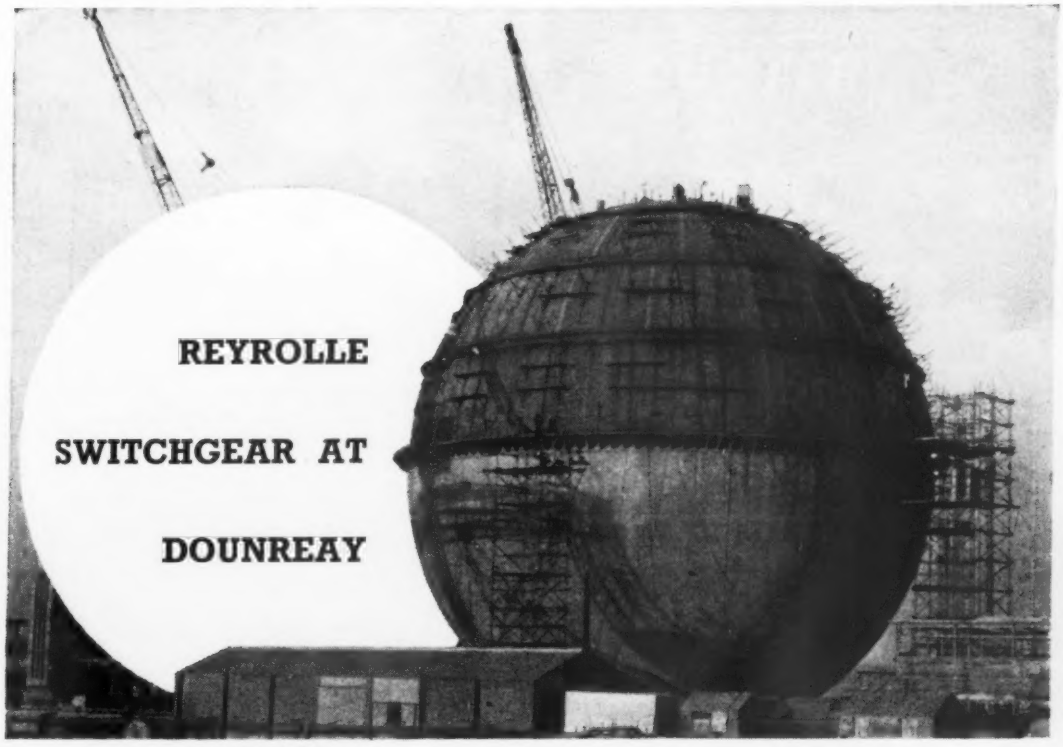
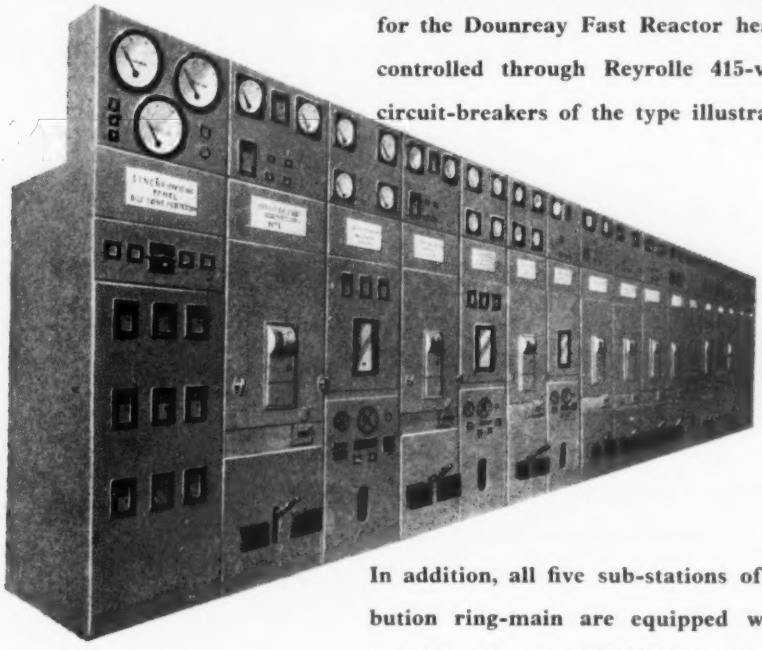


REYROLLE SWITCHGEAR AT DOUNREAY

Photograph by courtesy of the U.K.A.E.A

The electro-magnetic liquid-metal pumps and other services for the Dounreay Fast Reactor heat-exchanger system are controlled through Reyrolle 415-volt 31·5-MVA air-break circuit-breakers of the type illustrated.



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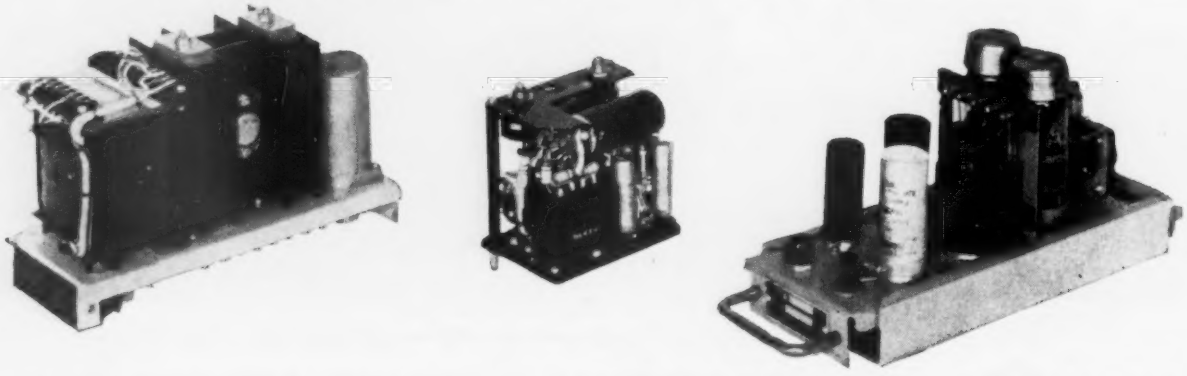

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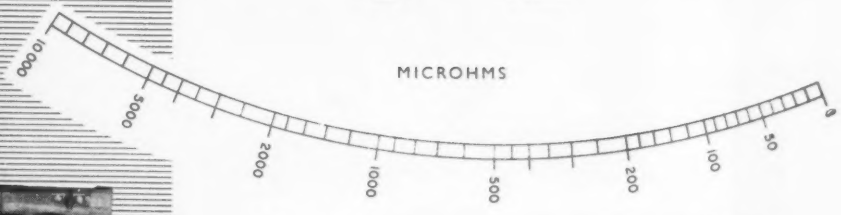

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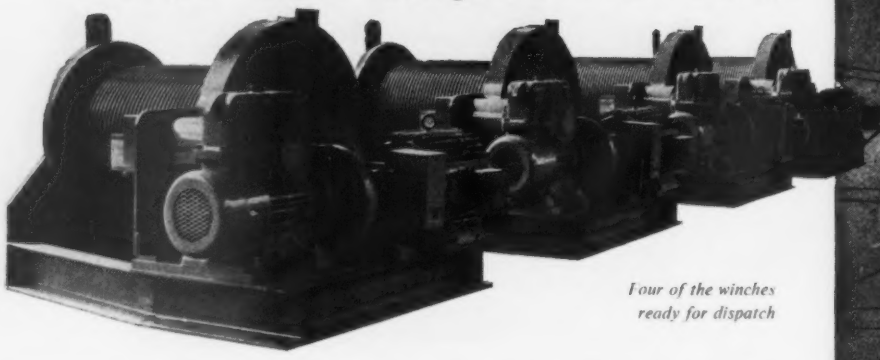
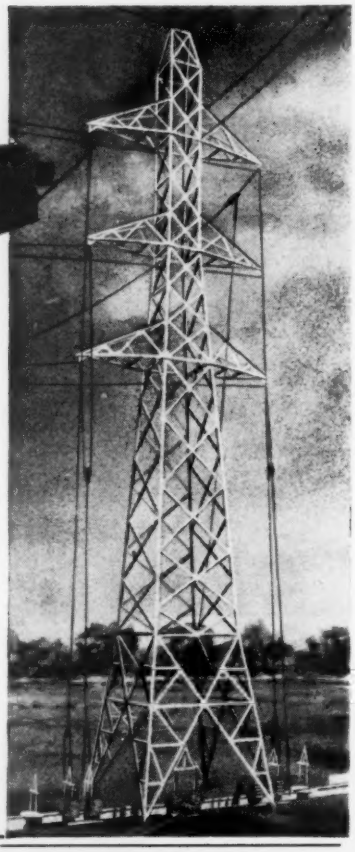


Four of the winches ready for dispatch



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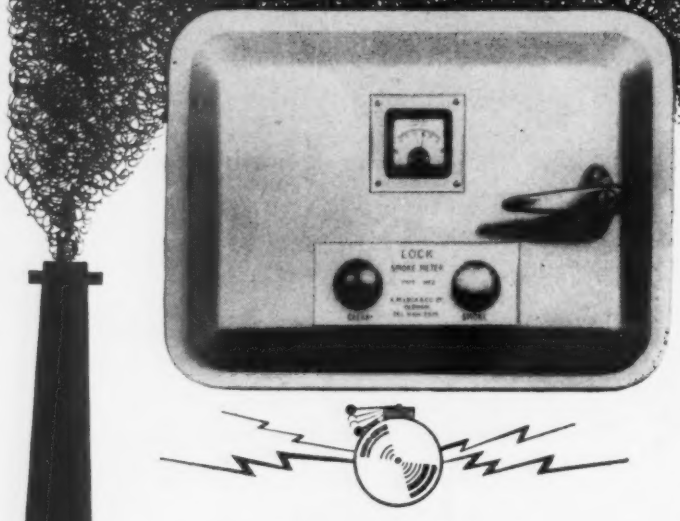

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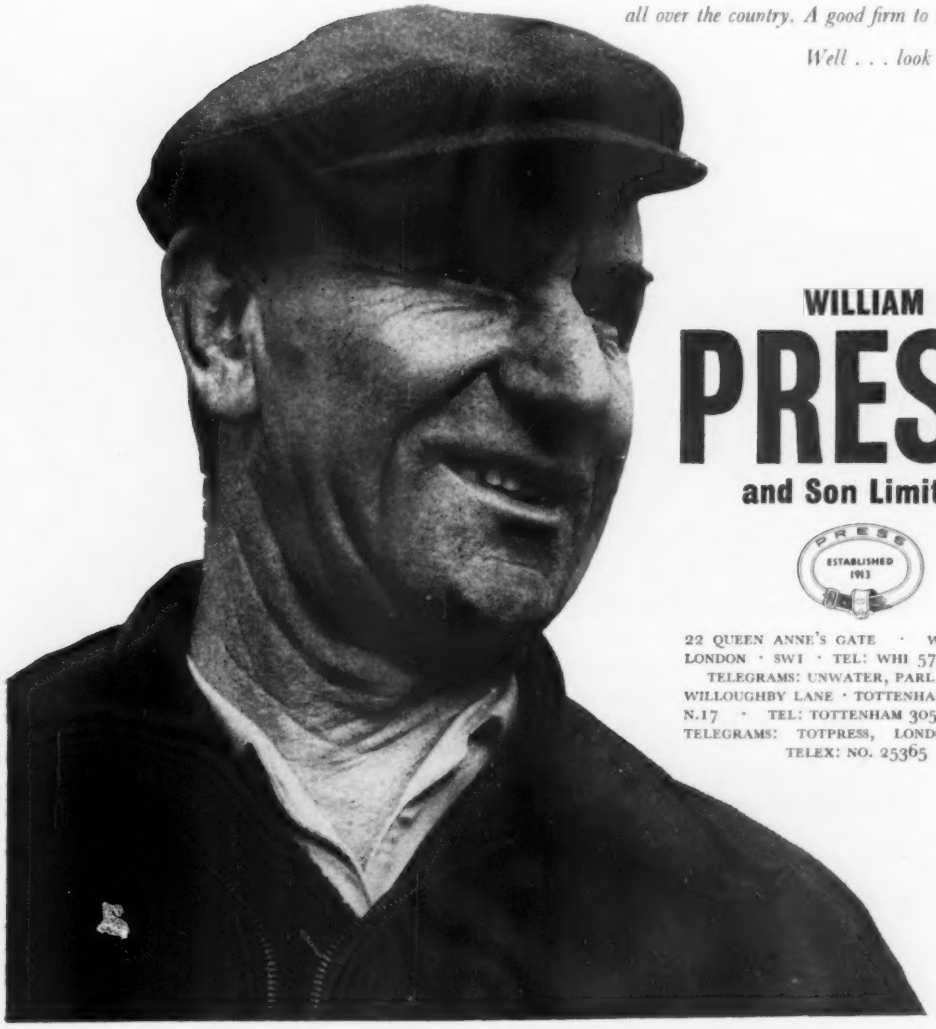

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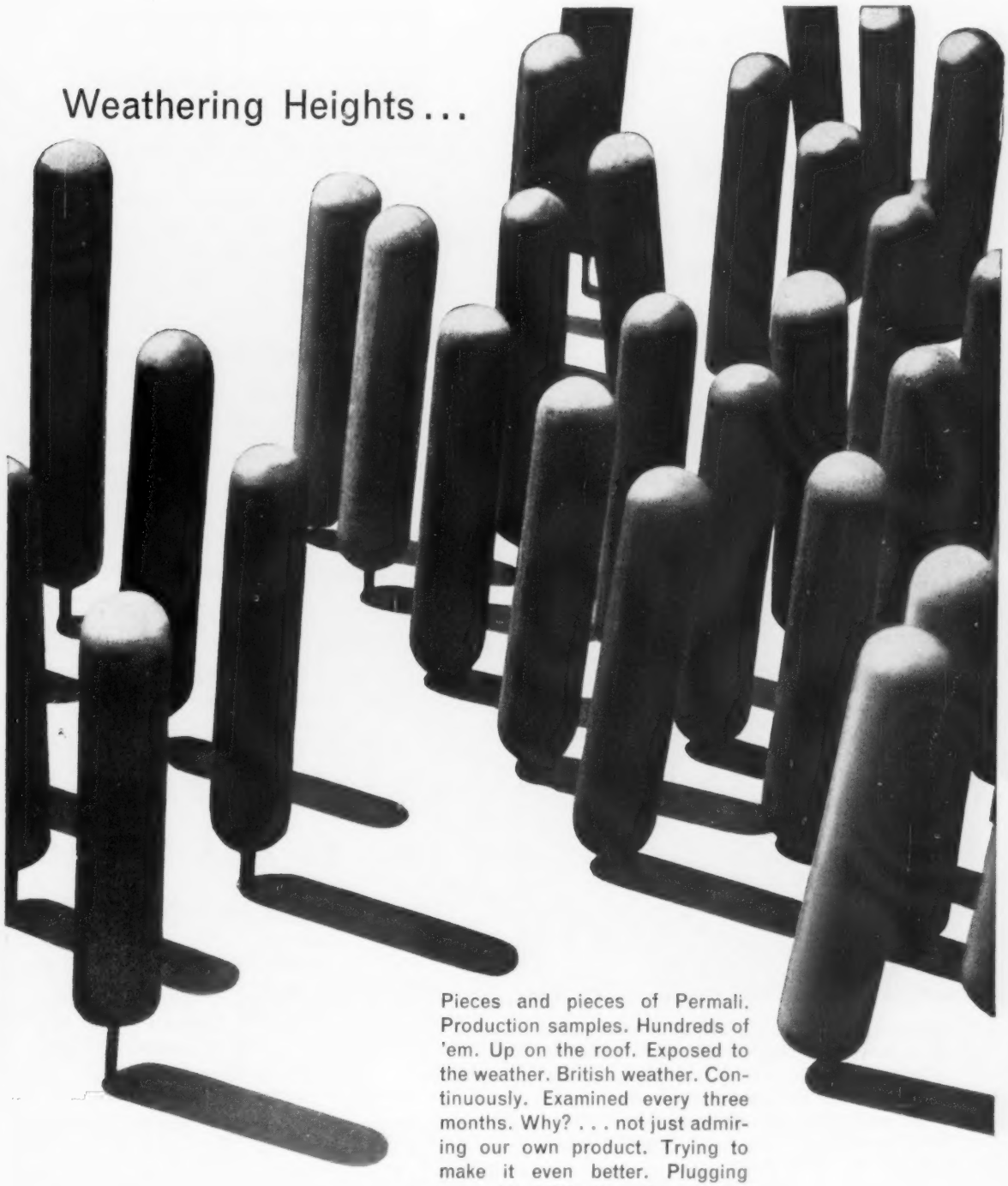

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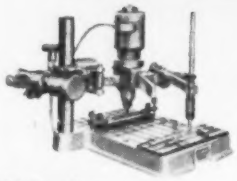

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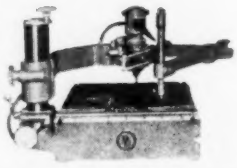

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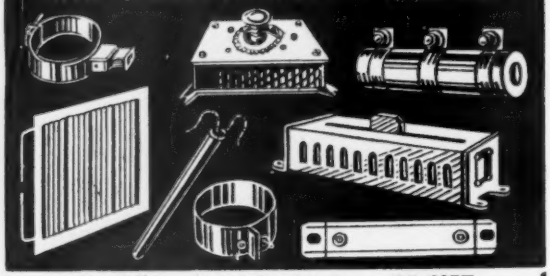

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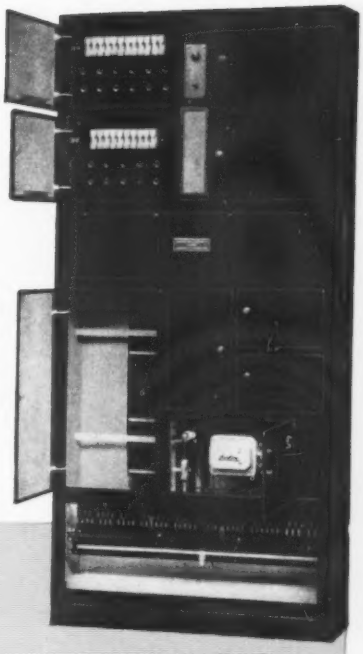
An unusual Cubicle Board (right) which provides a variety of lighting fuseboards with tumbler switch panels. It is installed in St. George's Chapel, Windsor.



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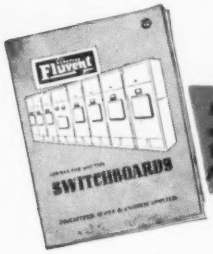
Installed in a modern manufacturing undertaking, this Board (above) protects one 300 amp. eight 100 amp. and eight 60 amp. 3 phase 4 wire outgoing circuits, and the incoming Cubicle on the left is provided with a 600 amp. main switch and metering facilities.

A compact Board (right) protecting one 300 amp. and two 60 amp. 3 phase 4 wire circuits and six 30 amp. single phase and neutral circuits, all under the control of a 600 amp. T.P. and Neutral incoming main switch.



Publication 323 illustrates and describes a selection of Cubicle and Unit Type Switchboards. A copy will be forwarded to you on request.

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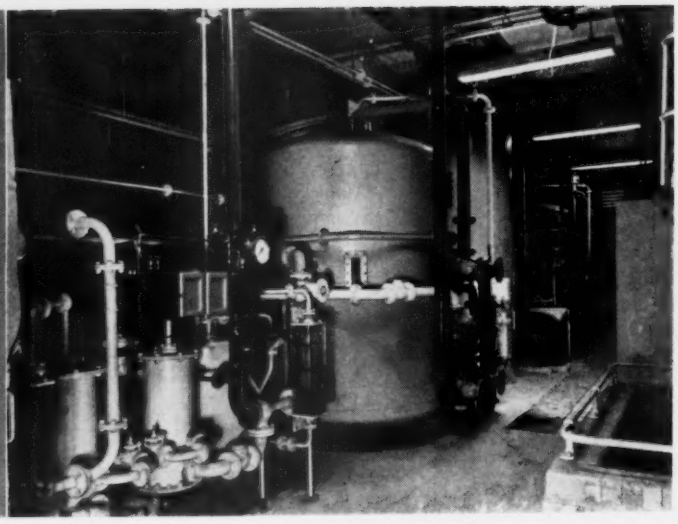
** The illustration shows de-ionisation plant at North Wilford Power Station producing 75,000 gallons of treated water in 14 hours for high pressure water tube boilers.*



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